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April 1951

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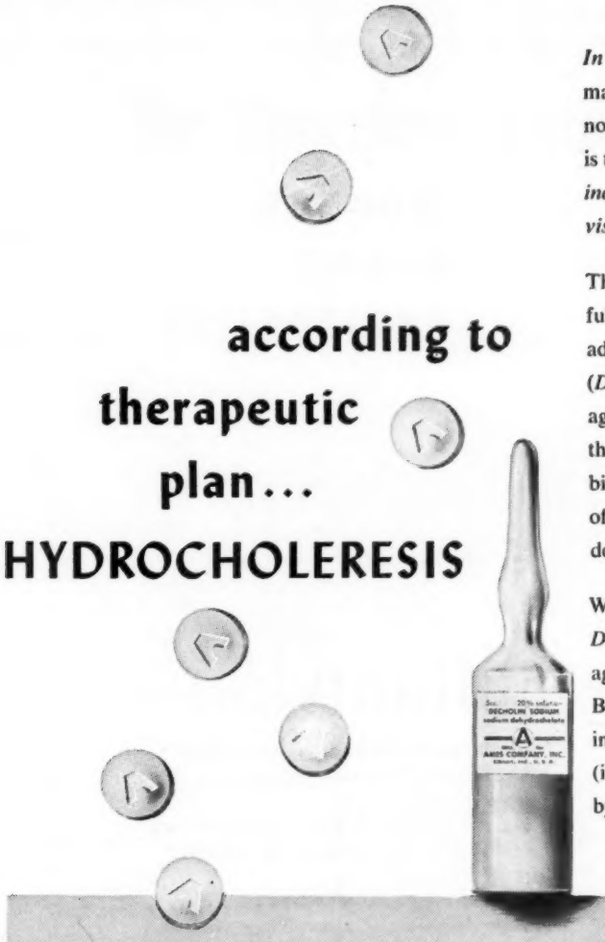

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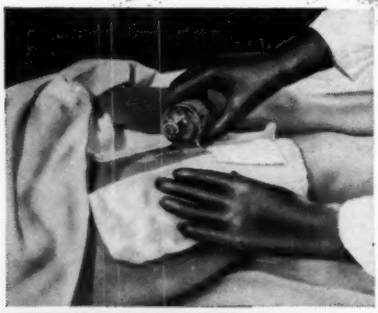

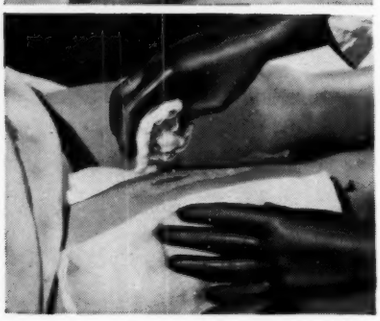

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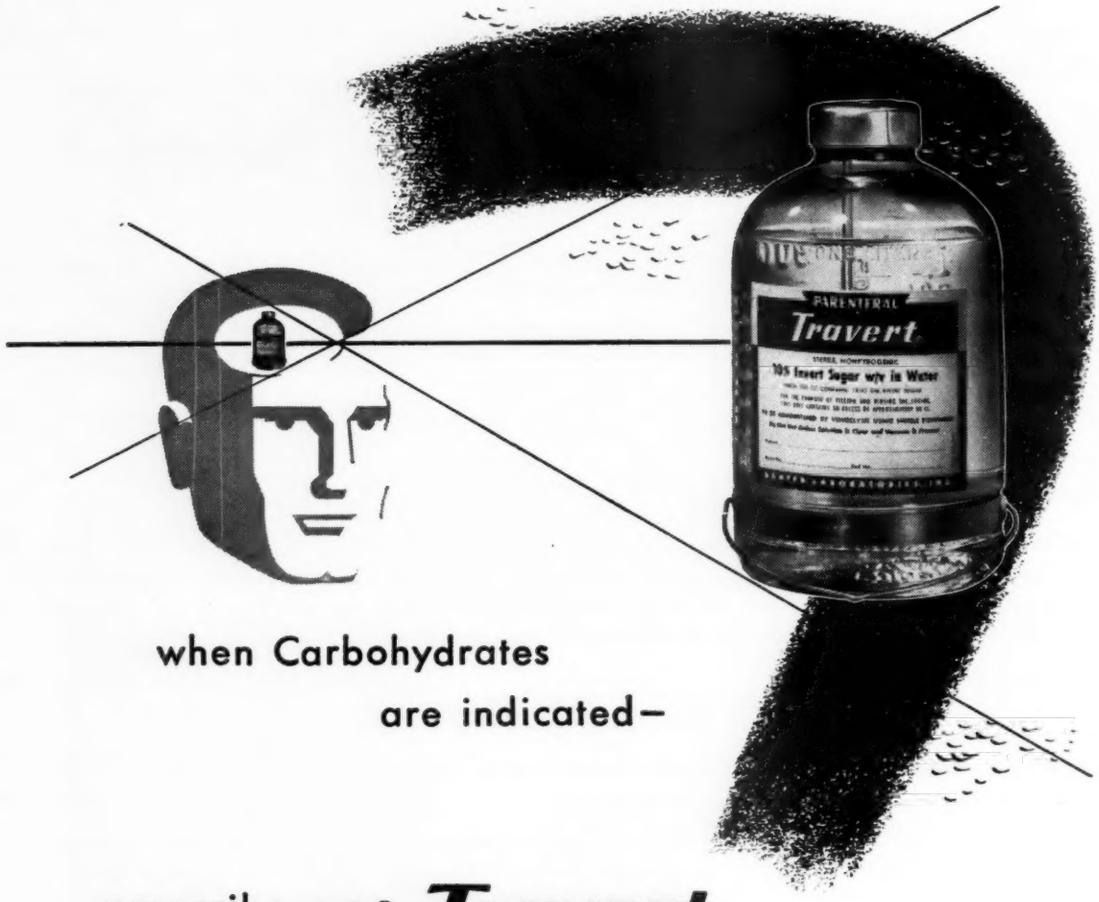

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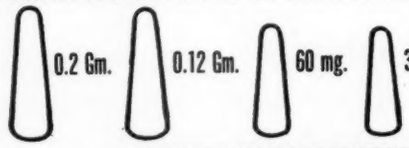

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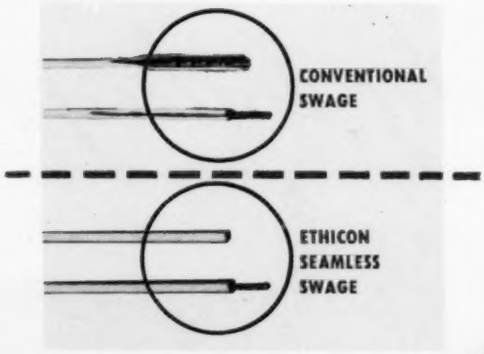

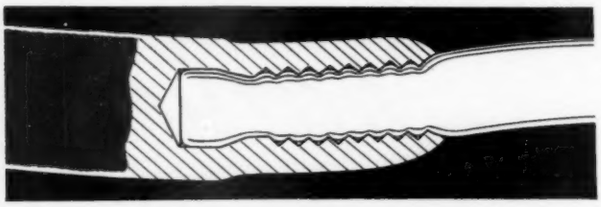

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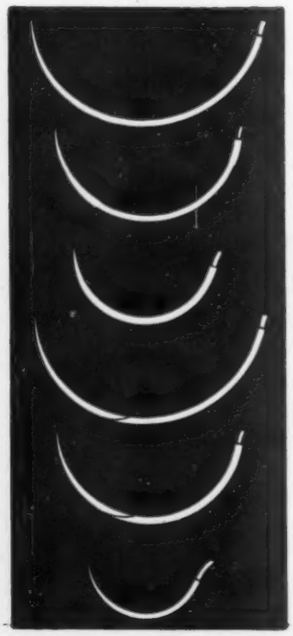

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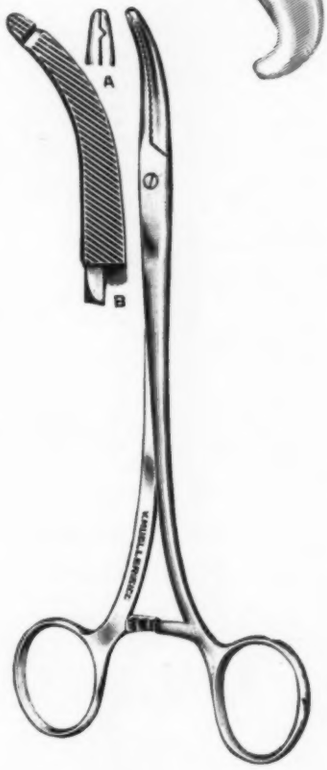

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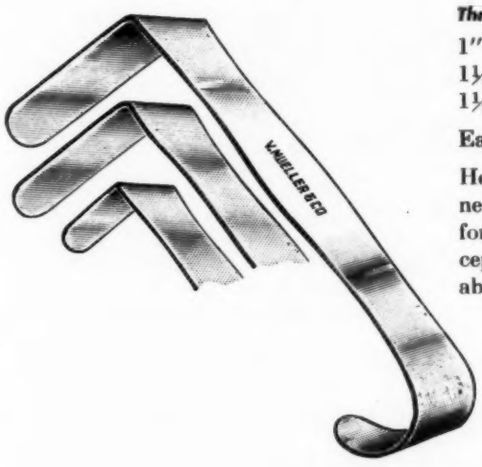

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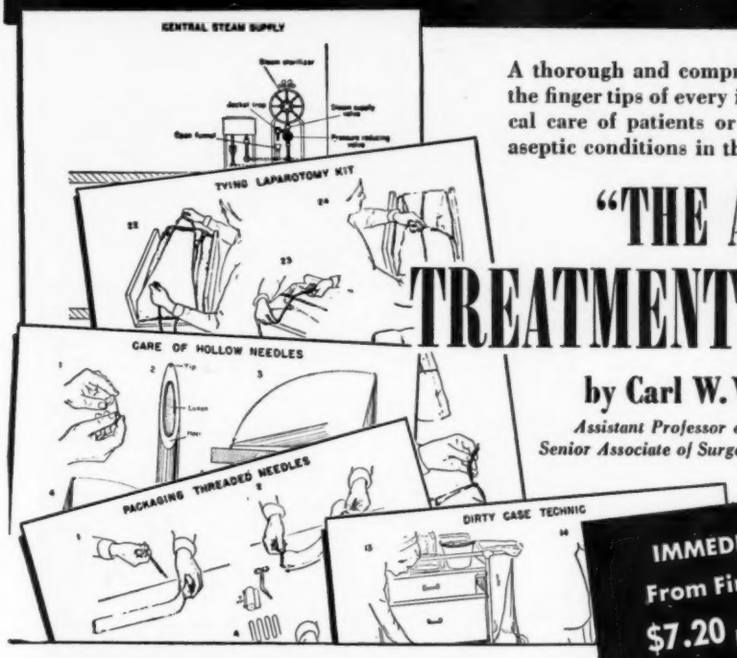

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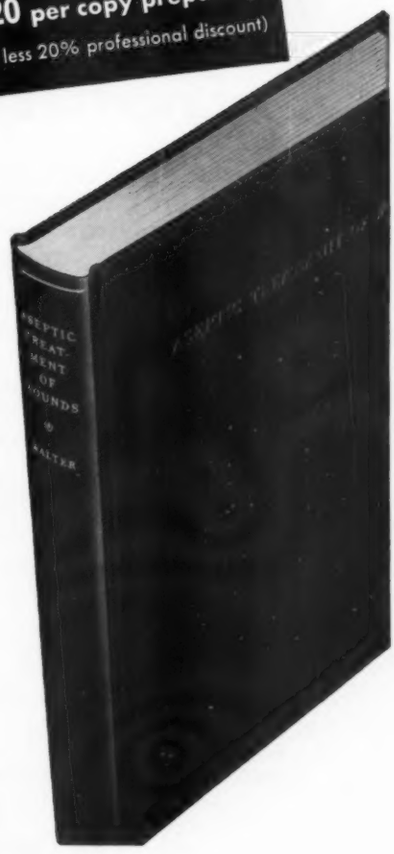

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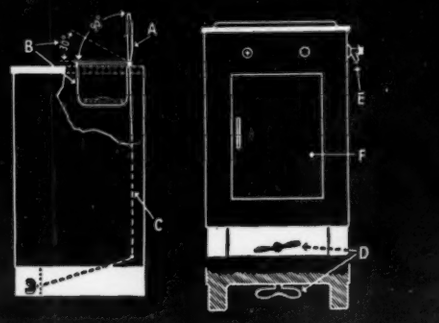

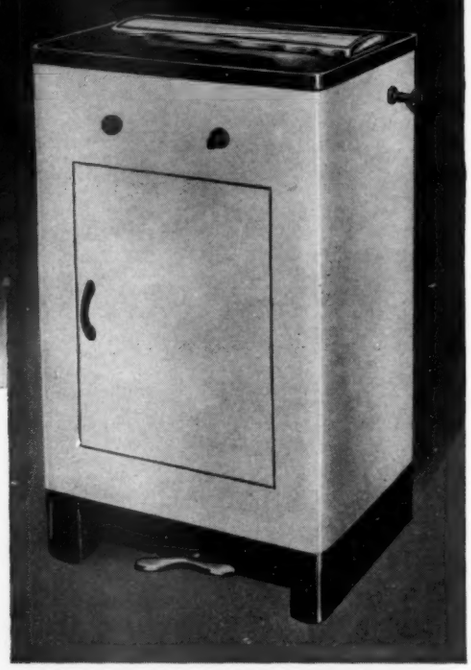

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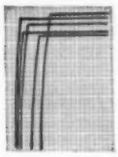

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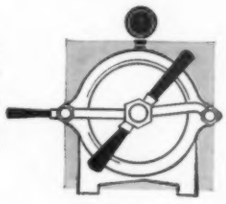

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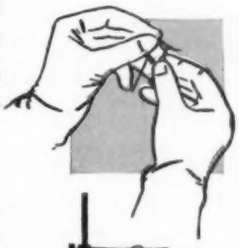

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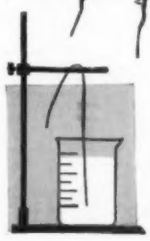

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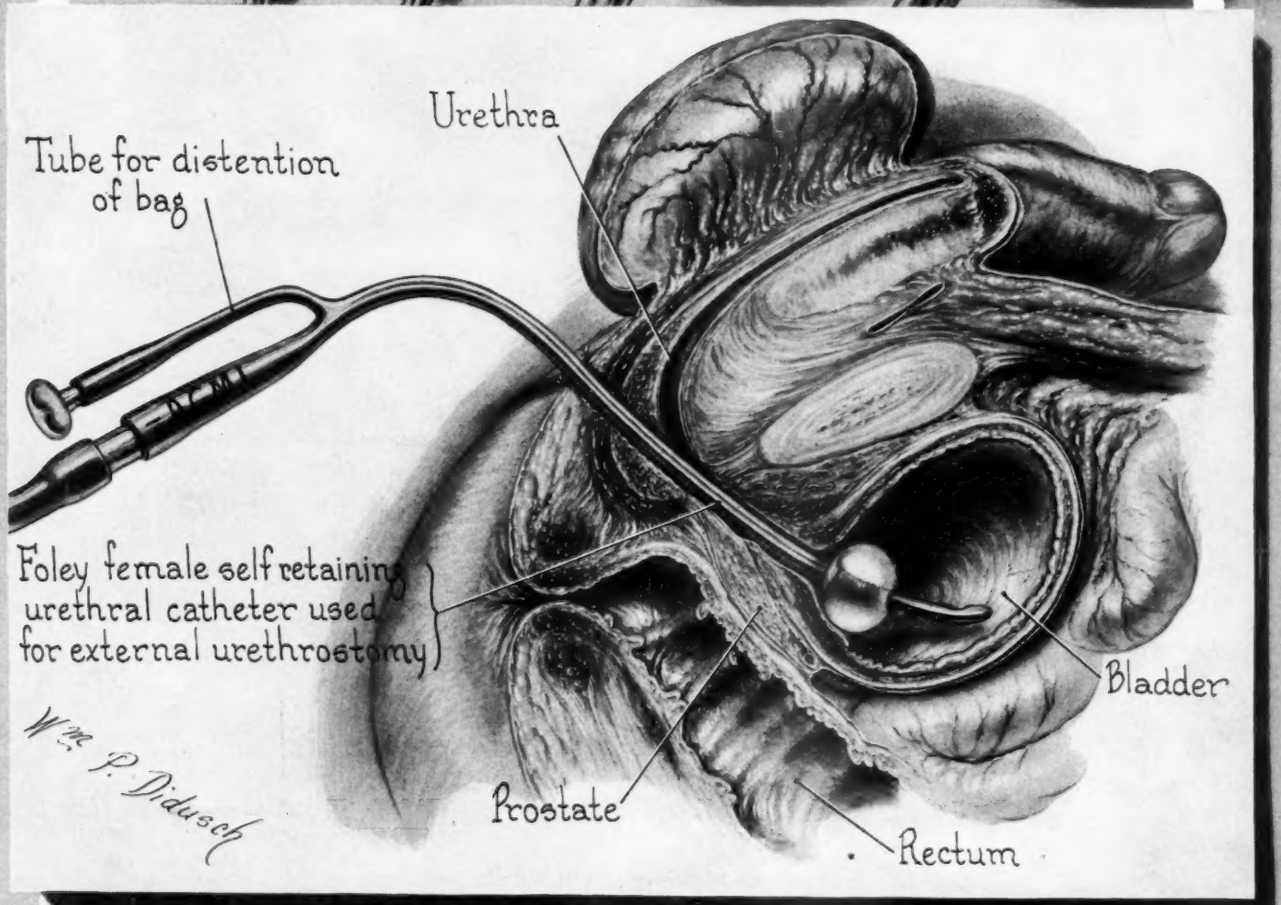

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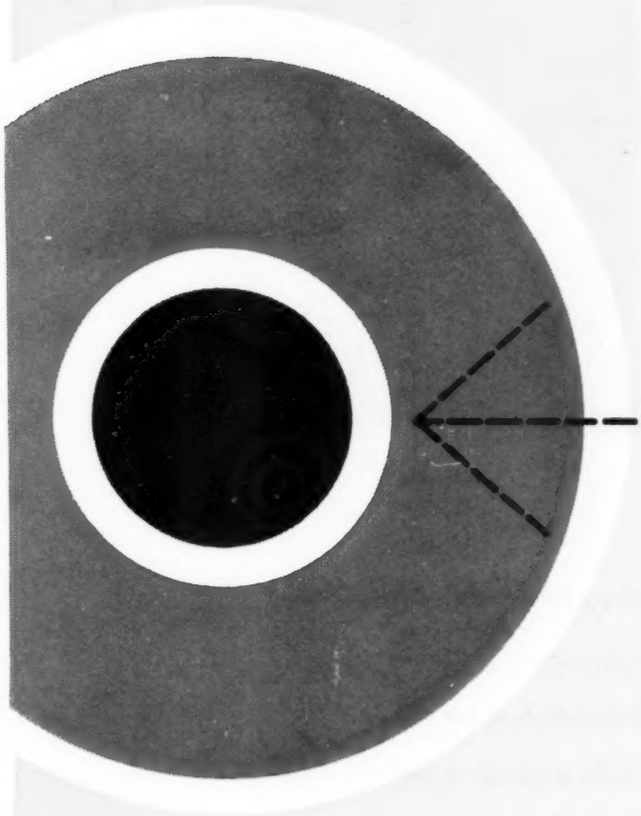

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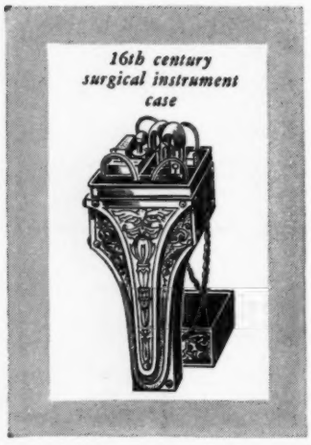

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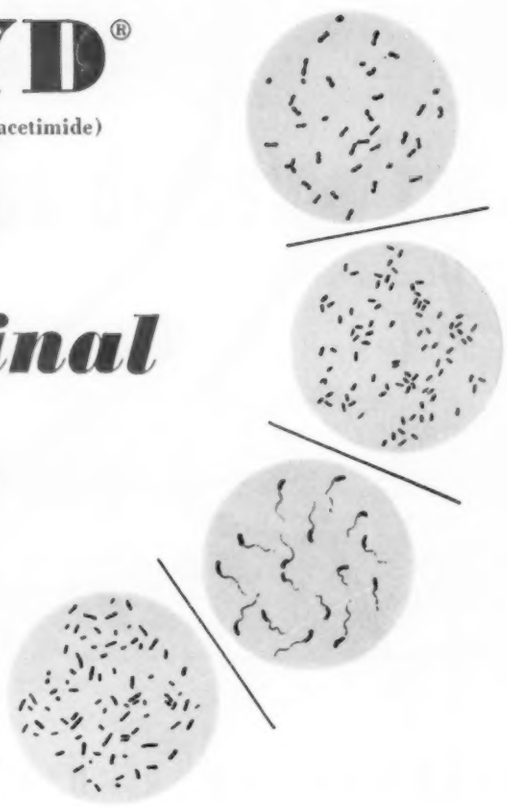

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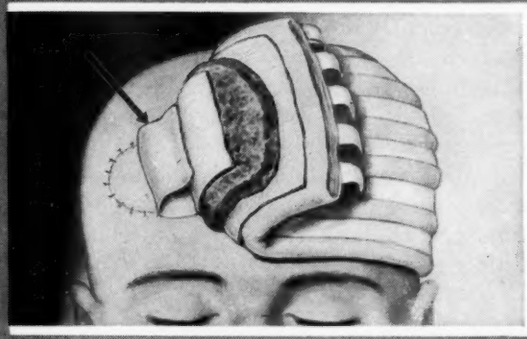

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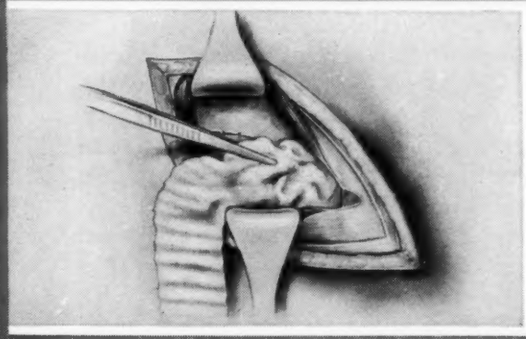

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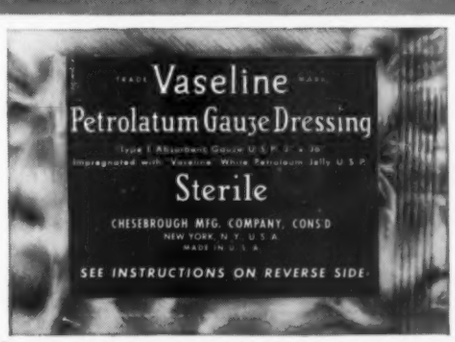

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Outside the Ivory Tower

The Red Cross was named official blood procurement agency for both the military forces and civil defense last August. Since then, every request for whole blood for Korea has been met and a large plasma stockpiling project has been started for military use. In addition, the Red Cross has contributed 80,000 100 cc. vials of serum albumin, a blood factor used in treating shock. In noting the blood program anniversary Dr. George F. Lull, Secretary and General Manager of the American Medical Association, commended the Red Cross for the three-year accomplishments of the blood program. "On behalf of the American Medical Association," he said, "I congratulate the American Red Cross on the outstanding work it has done with the blood bank program in the last three years. America's physicians pledge their continued support and participation in this patriotic nationwide effort."

In the development of both civilian and military procurement the Red Cross and the American Medical Association are working in close coordination. Mr. Harriman says "the cooperation of medical societies and local physicians throughout the nation has been of inestimable value in building our blood program to its present point. We shall lean heavily upon their continuing support in planning and operating blood procurement facilities during these times of pressure."

THE potential use of whole blood and its derivatives in medicine is incalculable and medical science, with the international situation serving as a catalyst, is on the threshold of another period of extremely rapid development in this field, Dr. Robert B. Pennell, Assistant Director of Immunochemical Research, Sharp & Dohme, Inc., told the monthly meeting of the Philadelphia Branch of the American Pharmaceutical Association. Dr. Pennell, who also serves as a member of the Red Cross "Formed Elements" blood research group headed by Dr. E. J. Cohn of the Harvard Medical School, enumerated the blood products already in use by the medical profession and described recent research developments that will lead to new products as well as improvements in those already in clinical use.

Up to the present time, Dr. Pennell pointed out, it has been possible to preserve whole blood for only twenty-one days. But research work has been recently reported by Dr. Max M. Strumia and his associates at the Bryn Mawr Hospital (Bryn Mawr, Pa.) showing that with slight changes in collection and storage methods the "life expectancy" of stored blood can be extended to at least sixty days. This will mean the saving of large amounts of blood in blood banks across the country that now must be destroyed after twenty-one days.

ACCIDENTS claimed approximately 89,000 lives in the United States during 1950, Metropolitan Life Insurance Company statisticians estimate. This is about the same number as in 1949. Fatalities in motor vehicle accidents, however, increased from 31,500 in 1949 to about 35,000 in 1950, a development viewed as "disturbing" by the statisticians. These accidents accounted for 40 per cent of all fatal mishaps for the year.

"There is little consolation in the explanation that the rise was accompanied by an increase in motor vehicle mileage to a record high," the statisticians maintain. "The facts point to a need for intensification of the safety campaign to promote better driving habits and to improve traffic control."

Accidents in and about the home, down from 1949, caused approximately 27,000 deaths. There were about 15,500 deaths from occupational accidents, including occupational motor vehicle fatalities, which is a slight increase over the 1949 figure. Deaths in public accidents (except motor vehicle) are estimated at around 13,000.

STRESSING the need for increased research into heart and blood vessel diseases in war and peace, A. W. Robertson, Chairman of the Board of the American Heart Association, announced the granting of Research Fellowship Awards totaling $173,800 to forty-one individuals. In addition, to encourage the development of new research skills, Mr. Robertson announced the award of $17,400 to continue a training school for cardiovascular investigators at Western Reserve University, Cleveland, under the direction of Dr. Carl J. Wiggers.

(continued on page 22)

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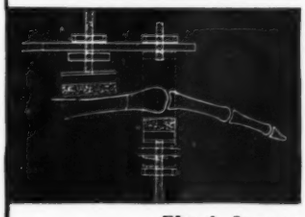

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Outside the Ivory Tower

(*continued from page 20*)

MEDICAL science triumphed in its contests with the antivivisectionists in the November 7th elections. In Baltimore and Los Angeles referendum show-downs were won hands down by the vast majority who want continuing medical progress. In the state of Illinois support of medical science was an important factor in the election of some members of the legislature. Baltimore's voters defeated by a score of 160,000 to 38,000 (or 4.2 to 1) the anti-medical cults' proposed charter amendment prohibiting the experimental use of dogs from the city pound. This vote matched the public sentiments reported by the National Opinion Research Center after a national survey last year which showed 85 per cent of the people favoring the use of unclaimed pound dogs for scientific studies. In Los Angeles the margin was closer than in Baltimore but it, too, bore out the national survey findings. Medical science won by 95,694 votes in a city referendum to determine whether or not unclaimed dogs and cats at the Los Angeles pounds should be saved for research use or killed, as had been the practice. The tally was as follows: For saving animals for scientific use, 357,393; against, 261,699. The national opinion poll had shown that Los Angeles had more than twice the national percentage of antivivisection crackpots. In the state of Illinois where a pound-animals-for-research bill was defeated by the legislature in 1949, candidates supported by the medical groups won by margins which showed the effect of medical support in critical contests. Outstanding was the defeat of one of the stalwarts of the state legislature by a relatively unknown woman who was given important publicity for her support of medical research.

THE use of music with therapy is increasing at a rapid rate at hospitals and at treatment and training centers throughout the nation, says Eugene J. Taylor, assistant professor of Clinical Physical Medicine and Rehabilitation at New York University's College of Medicine. Writing in the current issue of The Crippled Child Magazine, official publication of the National Society for Crippled Children and Adults, the Easter Seal Agency, Taylor points out that the increase in the use of music in hospitals in recent years is partially the result of its wide use in military hospitals during the war.

"For the arthritic, cerebral palsied, blind and other physically handicapped, music stresses active participation in both individual and group activities," adds the writer. "Such participation is used as a means of improving muscular coordination and morale building. For the emotionally handicapped, it is a means of contact, emotional release, self-expression and discipline."

In his article titled, "Music as an Adjunct to Therapy," Taylor says that music has a relaxing effect on patients. By listening to music and participating in its creation, patients can be kept busy, happy and often stimulated. Monotony and boredom are alleviated and the healing processes speeded, he asserts.

THE Federal Security Agency released the text of a letter from Dr. Leonard A. Scheele, Surgeon General of the Public Health Service, to the Health Directors of the States and Territories in which the full facilities of the Service are offered to the States in the development of medical civil defense plans. The letter is based on the volume, "Health Services and Special Weapons Defense," recently issued by the National Security Resources Board. Dr. Scheele called attention to the section of the volume which designates the ten Federal Security Agency regional offices for the time being as centers for technical assistance to the States in formulating, revising and maintaining civil defense health service plans. He also assured State Health Officers of the full cooperation of regional medical directors and the headquarters staff of the Public Health Service in meeting what he called "the most serious challenge our health services have ever met." Federal Security Agency Regional Offices are maintained in the following cities: Boston, New York, Washington, D.C., Cleveland, Chicago, Kansas City, Dallas, Denver, Atlanta and San Francisco.

THE American Goiter Association will hold a three-day meeting beginning May 24th at the Deshler-Wallick Hotel, Columbus, Ohio, and will consist of papers dealing with goiter and other diseases of the thyroid gland, dry clinics and demonstrations.

(*continued on page 42*)

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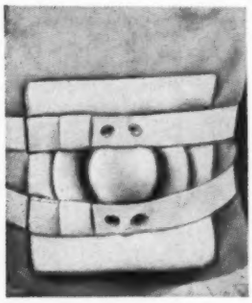

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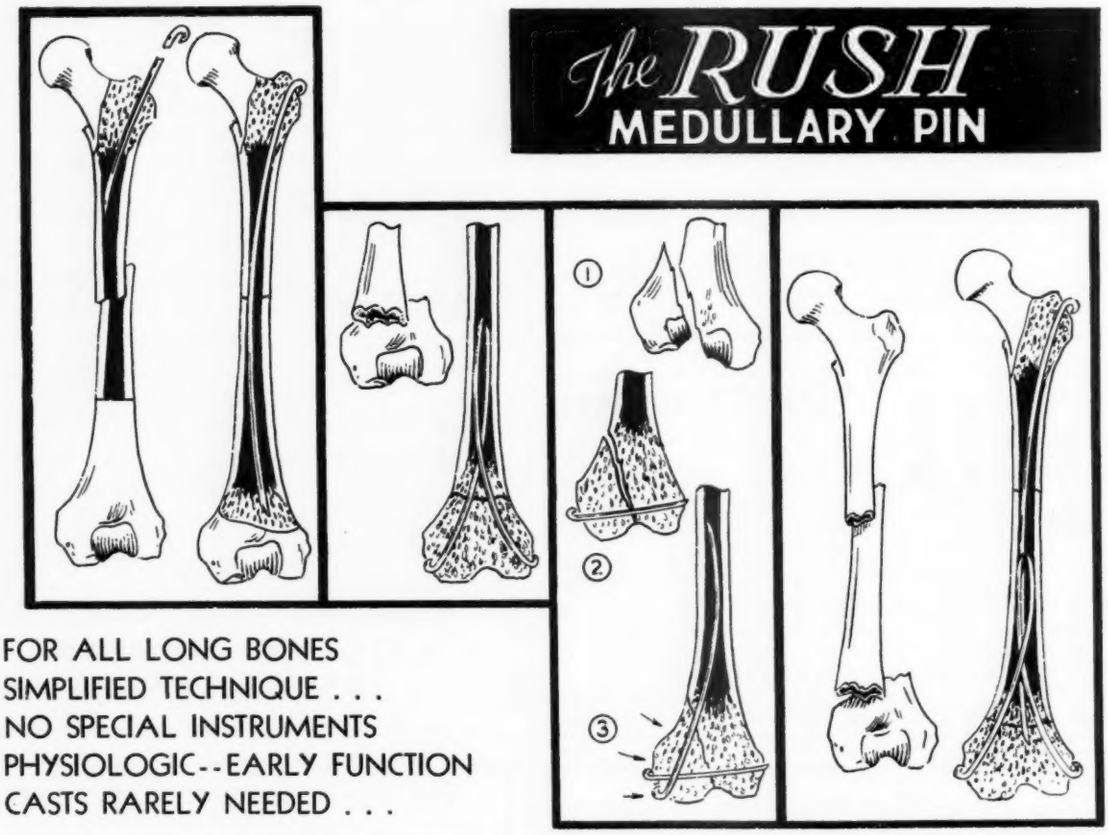

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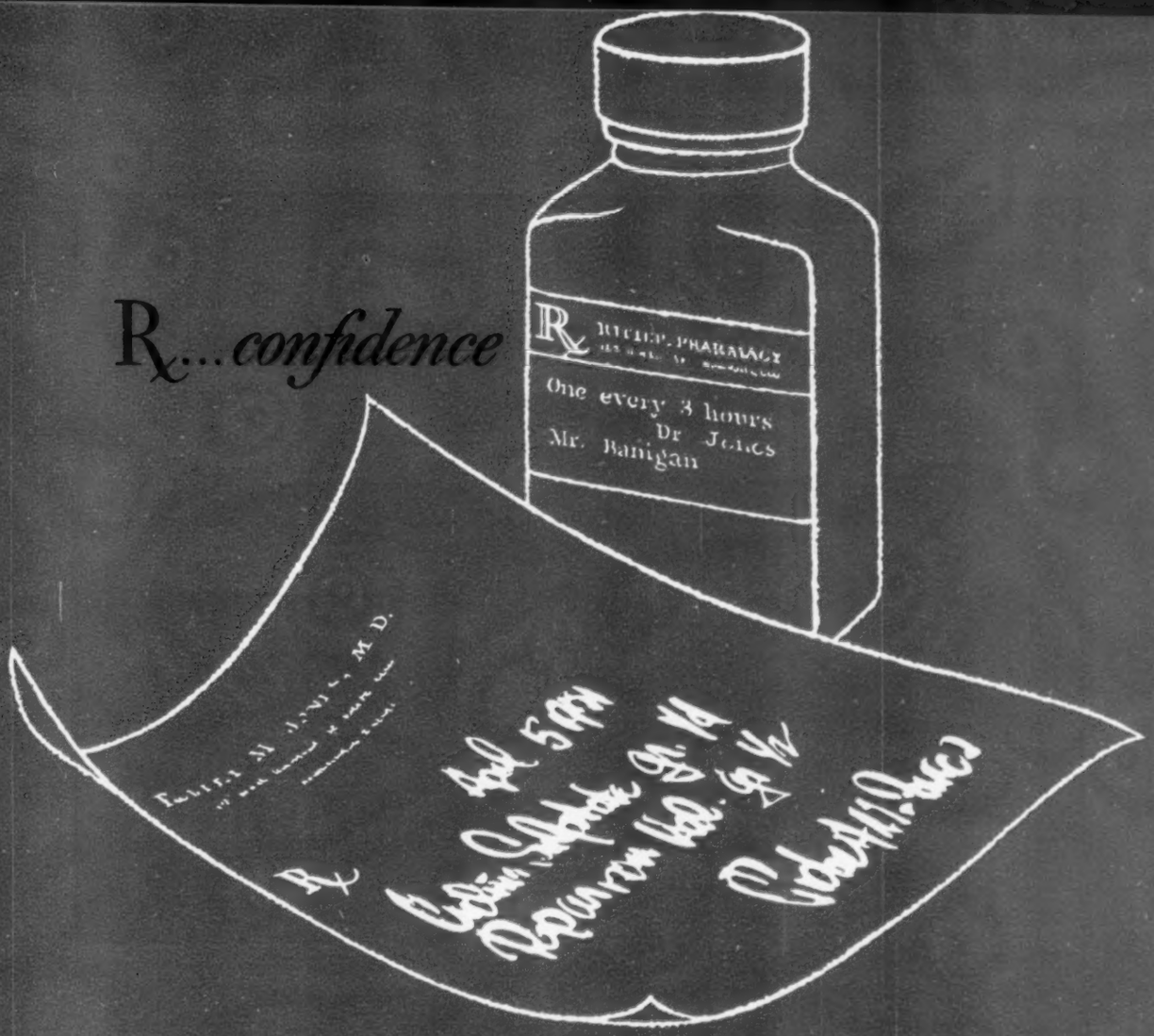

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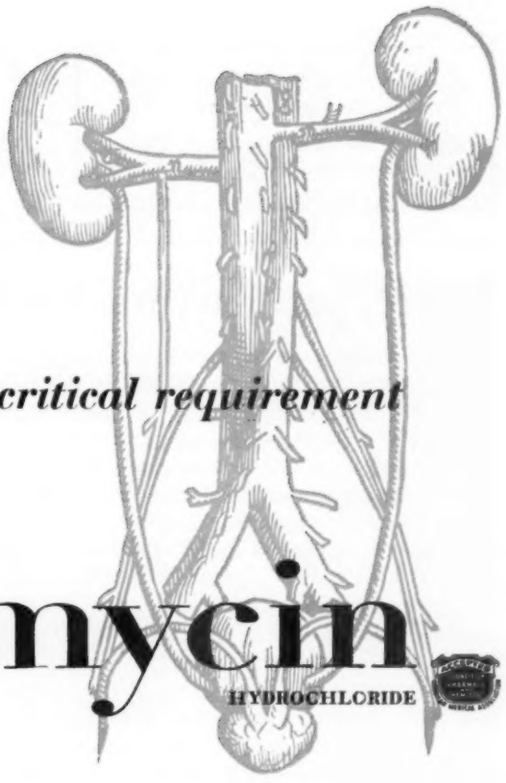

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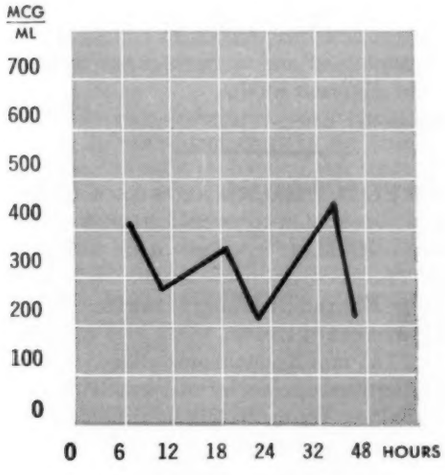

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1. Schoenbach, E. B.; Bryer, M. S., and Long, P. H.: Ann. New York Acad. Sc. 53:245 (Sept. 15) 1950.
2. Welch, H.; Hendricks, F. D.; Price, C. W., and Randall, W. A.: J. A. Ph. A. (Sc. Ed.) 39:185 (Apr.) 1950.
3. Welch, H.: Ann. New York Acad. Sc. 53:253 (Sept. 15) 1950.

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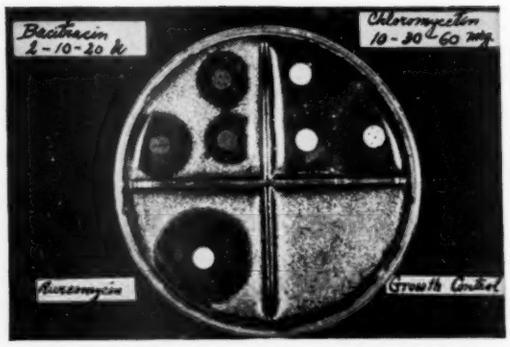

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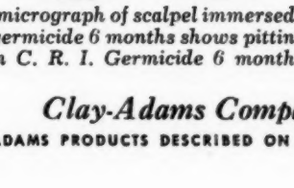

Photomicrograph of scalpel immersed in ordinary germicide 6 months shows pitting (left), and in C. R. I. Germicide 6 months, none.

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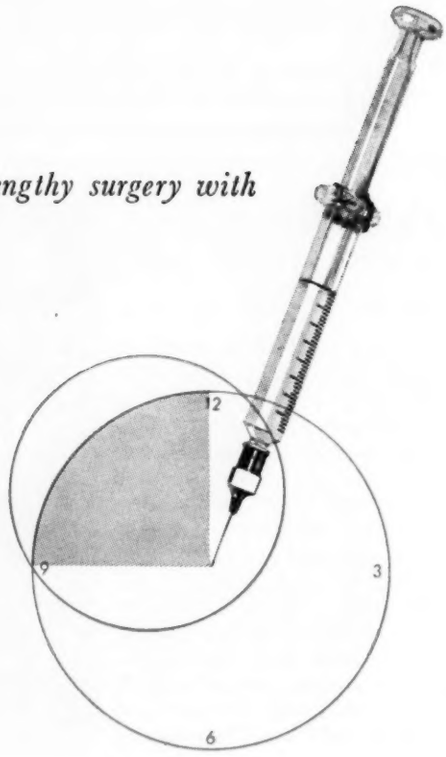

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Sixtieth Year of Publication

VOL. LXXXI APRIL, 1951 NUMBER FOUR

Editorial

THE CAT IS NOT DEAD

FOR many years we have subscribed to *The Atlantic Monthly*. We think it is a solid publication, a quality magazine, and look for it each month with anticipatory pleasure. Naturally we do not agree with all we read. This was true when we read an article by Dr. James Howard Means of Harvard University. However, we know Dr. Means is an outstanding figure in our profession and a gentleman of integrity. When we finished reading his article, we were upset and full of disagreement. We believed it was too bad the Editor of *The Atlantic Monthly* had not run another article by someone in authority on the opposite side of the subject. In the hurly-burly of everyday affairs the episode faded from our mind. Then came a mimeographed letter signed by Dr. Elmer L. Henderson, Chairman of the Coordinating Committee of the National Health Campaign of the American Medical Association. The reader will note it is in reference to a letter written by the Education Director of the Committee for the Nation's Health, Frederick E. Robin, and refers to Dr. Means' essay in *The Atlantic Monthly*.

We will quote Mr. Robins' letter, written October 19, 1950, and then follow it with Dr. Henderson's reply:

"I hope you found the Handbooks useful in providing friendly Senators and Congressmen and their aides with the necessary ammunition to combat the medical lobby. Perhaps, due to this ammunition and the efforts of all our friends, the AMA'S $20,000,000 propaganda drive seems to be falling far short of the mark.

"As the attached confidential letter from AMA President Elmer Henderson indicates, they are not getting the support they want. We are continuing to hit back as hard as we can and we may have whittled down the AMA's $20,000,000 goal to $2,000,000 or $3,000,000 in tie-in ads. But there are so many projects to be done and we have so little money—and it takes money even to put material into the hands of radio commentators, newspaper columnists, editors and others who are willing enough to use it.

"I know of your deep interest in this cause and so I won't burden you with a long pitch for funds. Whatever gift you could send us or could raise among your friends would be most helpful at this time.

"Let me cite just one example. Have you seen the wonderful article in the October issue of the *Atlantic* entitled 'The Doctors' Lobby'? It was written by the very distinguished Professor of Clinical Medicine at Harvard University, Dr. James Howard Means. If we could furnish reprints and send them around to a few thousand people and an equal number of the nation's leading doctors, it would have a telling effect out of all proportion to the few hundred dollars involved. *Dr. Means—although a conservative—is ready to lead a 'Young Turk's' movement within the AMA to liberalize it. You can appreciate what that would do to the opposition.*

"I am a poor salesman and so will close, hoping that the AMA's copy will do the job for me. I would very much appreciate the opportunity to see you and talk with you further if you desire."

Dr. Henderson's letter, written December 29, 1950, to state and county medical societies, follows:

"We know that many members of the medical profession were at a loss to understand the bitter animus and reckless distortions which characterized an article entitled, 'The Doctors' Lobby,' which appeared in the October issue of the Atlantic Monthly, signed by Dr. James Howard Means of Harvard University.

"A fund solicitation letter of the *Committee for the Nation's Health*, the lobby front for Compulsory Health Insurance, has been turned over to us by one of the recipients, which throws new light on the origin and motivation of this attack, and we are enclosing a photostatic copy for your information.

"Please note the paragraph in which the Committee for the Nation's Health boasts that Dr. Means is 'ready' to lead a revolt in AMA 'to liberalize it.' Note, too, the Committee's plea for funds to make possible the distribution of reprints of Dr. Means' article.

"You also should know that the alleged 'confidential letter' of mine, to which the Committee refers, was a mimeographed bulletin sent to all State and County Medical Societies, reporting progress in the advertising campaign. The Committee for the Nation's Health, in this letter, however, is trying to escape responsibility for its earlier false statements that the AMA planned a $20,000,000 propaganda drive —and resorts to the shabby trick of stating we failed to achieve the objective it had falsely stated.

"I think you will agree that the Committee for the Nation's Health, in this letter, has hit a new low 'for ways that are devious.'"

After the last election we thought the voters had about killed the Socialized Medicine issue. However, in his proposed budget the President submitted proposals for spending the overburdened taxpayer's money on this very issue. We thought "the cat had died" but evidently it still survives, and we comprehend why we received a bill for $25.00 from The American Medical Association, which all of us should cheerfully pay.

T. S. W.

Original Articles

SALIVARY TISSUE NEOPLASMS*

JAMES W. HENDRICK, M.D.,
San Antonio, Texas

GRANT E. WARD, M.D. AND MARVIN M. LACY, M.D.
Baltimore, Maryland

SALIVARY tissue, containing both stroma and parenchymatous elements, is subject to developmental anomalies, neoplastic proliferation, acute and chronic inflammatory diseases and injury. This article will be devoted in the main to the diagnosis and treatment of neoplasic diseases. The inflammations will be discussed largely from a differential diagnostic standpoint.

A workable classification of salivary lesions is as follows: (1) inflammatory lesions; (2) mixed tumors of salivary gland origin (benign and malignant); (3) muco-epidermoid tumors (benign and malignant); (4) anaplastic carcinoma; (5) adenoid cystic carcinoma; (6) Warthin tumor (papillary cystadenoma lymphomatosum); (7) secondary involvement of the salivary glands from malignancy in their drainage areas; and (8) primary lymphomas.

The parotid gland offers special anatomic problems from a surgical standpoint and, as shown by McWhorter[65] and Hamilton Bailey,[3] consists essentially of two lobes (Fig. 1), a larger superficial lobe and a smaller retromandibular lobe. These lobes are connected by an isthmus that winds around the ascending ramus of the mandible. The facial nerve, after leaving the stylomastoid foramen, passes anteriorly and slightly downward and lateralward to a position medial to the posterior part of the superficial lobe of the parotid gland and thence to the posterior edge of the isthmus where it divides into its goosefoot ramifications. Only a few of its filaments enter the substance of the superficial lobe which permits most benign tumors to be dissected without danger of injuring the facial nerve. Tumors arising in the superficial lobe, especially in its lower pole, frequently grow to enormous size without involving branches of the facial nerve; however, small tumors arising in the retromandibular lobe may involve the lower branches of the facial nerve early.

The retromandibular lobe extends practically to the lateral wall of the pharynx and is in relation with the internal carotid artery, internal jugular vein and last four cranial nerves. Tumors or infections developing in the retromandibular lobe produce symptoms early, with a resulting marked trismus. The external carotid artery and external jugular vein pass through the superficial lobe or isthmus.

Inflammatory lesions of the salivary glands frequently must be differentiated from neoplasms. Mikulicz's[22,28] disease and sarcoidosis[40] may either involve the parotid or submaxillary glands, or both. Either infection presents a slowly enlarging, tender, firm, bilateral tumefaction.

Calculi obstructing the duct of the submaxillary or parotid gland if not recognized but permitted to persist cause the gland to become diffusely enlarged; the gland parenchyma is destroyed and replaced by lymphocytic infiltration and fibrosis.

Cases are occasionally encountered with a history of gradual enlargement of one or more of the salivary glands that have no direct evidence of infection. The gland becomes diffusely enlarged, firm, slightly tender on firm pressure and immobile. If the parotid gland is affected, the lower branches of the facial nerve may be involved, with paralysis of the muscles supplied by the involved nerve fibers. If the disease persists, the gland finally shrinks in size and becomes very firm simulating malignancy. His-

* From the Tumor Clinic and Department of Surgery of Johns Hopkins University and Hospital, Baltimore, Md.

tologic examination of removed tissue reveals lymphocytic infiltration with fibrosis, the extent of the fibrosis depending on the length of time the malady has been present. Swinton and Warren[56] called attention to this condition and believed that there may be early sarcomatous changes. (Fig. 2.)

FIG. 1. Diagrammatic representation of cross section of parotid gland showing larger superficial lobe, smaller retromandibular lobe, connected by isthmus; the branches of the facial nerve passing around the isthmus. (HAMILTON BAILEY, *Brit. J. Surg.*, 28: 337, 1941.)

Lymphoid tissue in varying amounts is contained in the superficial and deep parts of the salivary glands. It may be the seat of primary malignant lymphomas or metastases from epithelial malignancy in the lymph drainage areas. Such conditions present problems from a differential diagnostic standpoint.

Mixed Tumors of Salivary Tissue. Mixed tumors are the most common neoplasms and affect all salivary tissue:[25,30,23] parotid, submaxillary, sublingual and aberrant salivary tissue wherever located. The parotid gland is more frequently involved by benign and malignant tumors than other salivary tissue. Stein and Geschickter,[54] in a study of the tumors of the parotid gland at the Johns Hopkins Hospital from the date of its formation until 1931, collected 241 cases. One hundred ninety-nine (or 83 per cent) were mixed tumors. We continued this study from 1931 until the present writing, collecting 141 tumors involving all salivary tissue; 122 (86.5 per cent) were mixed tumors, either benign or malignant. (Table 1.)

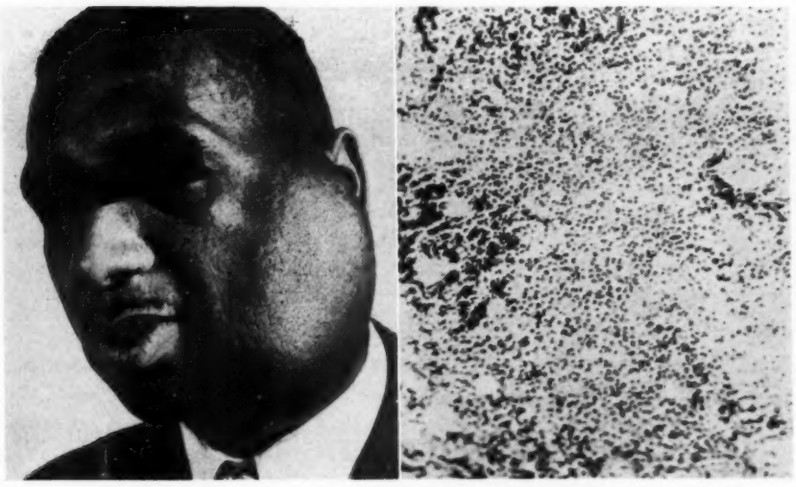
The derivation of various tissue elements encountered in mixed tumors of the salivary tissue[11–14] has been the basis of a lively discussion since these tumors were first described by Kaltschmied[31] in 1752. The epithelial, endothelial, and connective tissue derivatives[33,36,37,41,43,44] have continued[19,29] to be the subject[51,56,57,61] of controversy to the present.[2,8–10] We will not engage in this still prevailing controversy as it will add nothing of importance to this article.

TABLE 1
MIXED TUMORS OF SALIVARY TISSUE IN 141 CASES

	No. of Cases	Percentage
Parotid gland tumors	100	70.9 of total
Benign mixed tumors	75	75 of this group
Mixed tumors with malignant change	9	9 of this group
Submaxillary gland tumors	24	17 of total
Benign mixed tumors	18	75 of this group
Mixed tumors with malignant change	3	12.5 of this group
Aberrant salivary tissue tumors	17	12 of total
Benign mixed tumors	11	64 of this group
Mixed tumors with malignant change	7	41 of this group

Mixed tumors are about equally encountered in males and females. No age is exempt; the youngest patient in this group was eight years of age and the oldest eighty-one. Mixed tumors are usually non-tender, unless the center is cystic and a recent hemorrhage has taken place, which may rapidly increase the size of the tumor. This was observed in a patient who had a mixed tumor of the left parotid gland for a period of fourteen years. Following a blow over the tumor there was rapid increase in its size; it was tense and painful with marked trismus and impairment of the lower branches of the facial nerve. Malignant transformation was suspected. Recent hemorrhage was found when the tumor was sectioned at operation.

Mixed tumors vary in their rate of growth; those containing large amounts of epithelial tissue and deeply located have a more rapid



2A 2B

FIG. 2. A, history of enlargement of left parotid gland over a period of three years; gland is tender, diffusely enlarged, with no evidence of a neoplasm being present. B, histologic examination reveals little parenchymatous tissue remaining. Marked lymphocytic infiltration and extensive fibrosis.

growth than those containing fibrous myxomatous tissue and superficially located. Mixed tumors vary from 1 to 2 cm. up to the size of a large grapefruit.

The typical mixed tumor of the parotid develops as an ovoid, bosselated tumor below and in front of the ear. They are seldom encountered in the upper area of the gland, in contradistinction to malignancies, cysts and adenomas.[26] The tumor is at first freely movable in the underlying tissue unless located deep within the substance of the gland. As the tumor enlarges, the skin over it frequently becomes atrophic and thin as a result of pressure; if rapid growth develops,[23] there may be necrosis. The facial nerve is infrequently involved[52] unless malignant transformation ensues or the tumor develops in the retromandibular lobe. Pressure necrosis of the ramus of the mandible was observed in two of our cases in which the tumor was located in the retromandibular lobe.

Mixed tumors comply with their name by being a complex structure composed of epithelial elements in the form of cell strands, diffuse masses, alveoli interspersed in mesoblastic tissue made up of varying amounts of hyaline or myxoid connective tissue,[20,22,23] cartilage or mucous tissue. There is no uniformity of pattern; one area of the tumor may have a preponderance of one element while another area, or areas, shows preponderance of other elements.

Foote and Becker[21] recently described a muco-epidermoid type that arises from the duct epithelium and has a characteristic histologic structure composed of two elements, namely, squamous cells and tumor cells that produce mucin. This type composes approximately 5 per cent of the entire group of mixed tumors.

Papillary adenocystomas[45,62] are seen in mixed tumors. This type of tissue simulates that found in aberrant thyroid tissue except there are no follicles or colloid. Papillary projections were noted in the ducts of three patients and may be construed to be evidence of low grade malignancy.

Recurrent tumors retain their original structure to a degree. The secondary growth is more cellular and has a greater tendency to become malignant. Rapidly developing recurrences occasionally have the appearance of a sarcoma[52,54,57] in which round cells or spindle cells predominate, producing the so-called *sarcomas of salivary tissue.*

Malignant Mixed Tumors. Malignant mixed tumors occur in a gland that has not been previously operated upon or one that was incompletely removed.[3,52] Their growth is slow as contrasted with primary malignancies. A mixed tumor may have been present for a number of years or recurred immediately after an incomplete operation, with recent increase in size, fixation, invasion, pain and involvement of the lower branches of the facial nerve. A young colored male eighteen years of age entered the clinic with a mixed tumor of the left

submaxillary gland of three years' duration. It had been removed elsewhere and had recurred within a few months. Examination revealed a firm, fixed tumor of the left submaxillary gland region. At operation a mixed tumor with carcinomatous changes and metastases to the lymph nodes in the immediate drainage area were found. A radical neck dissection was done on the side that contained the tumor. There has been no evidence of recurrence in four years.

Early recurrences, when malignant mixed tumors are incompletely removed, may appear as small, movable nodules beneath the skin. This was noted in four patients operated upon elsewhere. Also, the tumor may be large, infiltrating and involving the surrounding structures. Recurrent tumors tend to remain locally invasive; consequently, extensive recurrences frequently are amenable to adequate surgical[52,58] removal, which is not true in primary malignancies.

Frequently it is difficult to distinguish between benign mixed cell tumors and those containing malignancy. After one or several recurrences all histologic evidences of mixed tumor may have disappeared, the entire tumor being composed of large, deeply staining epithelial cells with or without alveolar arrangement, or the cells may be oblong or spindle-shaped. These latter types show rapid invasion of the capsule and other tissues but seldom metastasize. On the other hand, there may be little change in the connective tissue cells or epithelial elements from those seen in a definitely primary benign tumor. When malignancy ensues, the cells vary in size and shape, are larger and stain more deeply, with evidence of rapid cell proliferation and invasion.

TABLE II

DIFFERENTIATION BETWEEN BENIGN AND MALIGNANT SALIVARY GLAND TISSUE TUMORS

History	Benign Tumors	Malignant Tumors
Clinical history:		
Rate of growth	Slow in years	Rapid—months
Sex	No essential difference	More frequent in females
Age	Between 20 and 45 yr. of age	Average 55 yr. of age
Pain	Usually absent	Invariably present early
Physical examination:		
Fixation	Freely movable in the superficially located; more limited movement of the ones developing in substance of the gland	Fixed to skin, deep structures and bone
Facial nerve paralysis (parotid tumors)	Unusual	Common in 40% of the cases
Consistency	Firm, cystic, nodular	May be stony-hard
Gross pathology	Well circumscribed and contained in capsule	No capsule, diffuse invasion of contiguous tissue and bone
Microscopic pathology	Wide variety of cell patterns and myxomatous stroma	Adenocarcinoma, alveolar carcinoma, atypical carcinoma, showing round or spindle cell
Metastases	Infrequent	Frequent lymph nodes, lungs and osseous system

Adenomas and cysts of salivary tissue[28,63] are not frequently encountered. They begin as small encapsulated nodules of gland tissue and are thought by some[20,22,24] to be congenital displacements. They more frequently occur in the upper lobe of the parotid and are infrequently encountered in the submaxillary or sublingual glands. They occur as an encapsulated solid or cystic mass found in the substance or near the surface of the gland. Their growth being slow, their size may vary from that of a pea to an English walnut. On section the cut surface reveals either a cystic or solid tumor. The solid tumor is composed of reddish glandular tissue which may be lobulated by transverse septa.

Histologically the structure is alveolar, with a reproduction of the acini of the glands with

papillary or cystic formation. The stroma shows absence of mucoid or cartilaginous deposits, as seen in mixed tumors.

The treatment of adenomas and cysts of salivary gland tissue is surgical excision, removing an adequate area around the tumor.

Primary malignancy of salivary tissue is more commonly encountered in an older age group, as noted in malignancy elsewhere in the body. Malignancy developing in aberrant tissue may occur at any age. It was noted in one child of seventeen months; in another, eighteen months of age.

There is a history of rapid development, the lesion being present for months rather than years. (Table II.) The growth more frequently begins in the upper pole or in the retromandibular lobe. Pain develops early due to rapid expansion of the tumor within the capsule and pressure on the sensory nerves; in the latter stages pain is intense. The tumor becomes fixed early to the surrounding structures. Its consistency is firm to stony hard. The facial nerve is involved early in about 40 per cent of the cases, with paralysis of the muscles enervated. If the tumor arises in the retromandibular lobe, trismus develops, interfering with mastication, and there is pain on the involved side on swallowing. X-ray examination may reveal destruction of the ramus of the mandible. (Fig. 3.)

Primary malignancies may grow with such rapidity that they simulate an inflammatory lesion. The cervical and supraclavicular lymph nodes should be carefully examined for metastases. Primary malignancy of the parotid and submaxillary gland and secondary malignancies, to a lesser degree, metastasize to the regional nodes, the lungs and the osseous system. A roentgenologic examination should be made of the mandible, zygoma and base of the skull to determine if the disease has extended to the adjacent osseous system.

Histologically there are three main varieties of primary carcinoma of salivary tissue, namely, adenocarcinoma, alveolar carcinoma and atypical carcinoma (Ewing[20]). Adenocarcinomas[21,22,30] may be either papillary or alveolar in form, the former developing from the ducts and the latter from the acini. The alveolar type reproduces more or less exactly the acini of the gland. Cylindromas[42–44,53] composed of cords or masses of epithelial cells, including spaces filled with mucus, are described as a form of adenocarcinoma. The connective

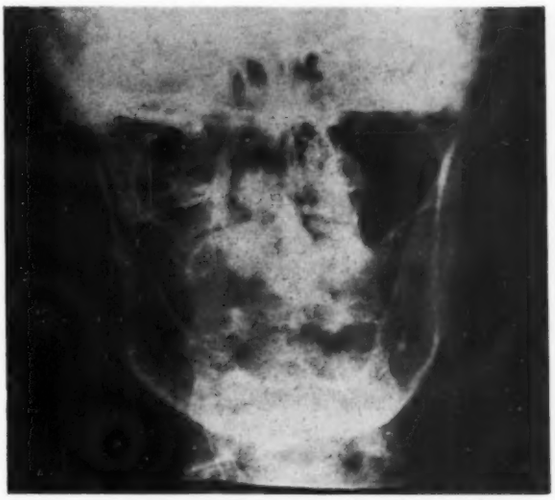


FIG. 3. Roentgenogram showing destruction of ascending ramus of mandible due to infiltration of primary carcinoma of parotid gland.

tissue around these epithelial strands may show mucoid degeneration or hyalinization. The structure may simulate a basal cell carcinoma of the adenocystic type. (Fig. 7D.)

Atypical[20,21,25] or anaplastic types of carcinoma, composed of round or spindle cells, have been described as either round or spindle cell sarcomas. Two such tumors were noted in this group.

In a series of cases at the Johns Hopkins Hospital reported by Stein and Geschickter the incidence of malignancy in parotid tumors was 17.4 per cent. The incidence of malignancy in the present series in which all salivary tissue tumors are included was 24 per cent. The tumor developed in a previously normal gland in 14 per cent and had its origin in a mixed tumor that had been present for several years in 10 per cent. (Table III.)

TABLE III
MALIGNANT SALIVARY TISSUE TUMORS

	Total No. of Cases	Total No. of Malignancies
Parotid gland		
Stein and Geschickter	241	42—17.4%
Hendrick-Ward-Lacy	100	
Primary malignancy 13—13%	...	22—22%
Malignant mixed tumors 9—9%		
Submaxillary gland	24	
Primary malignancy 3—12.5%	...	6—25%
Malignant mixed tumors 3—12.5%		
Aberrant salivary tissue	17	
Malignant mixed tumors	...	7—41%
Total	382	76—19.9%

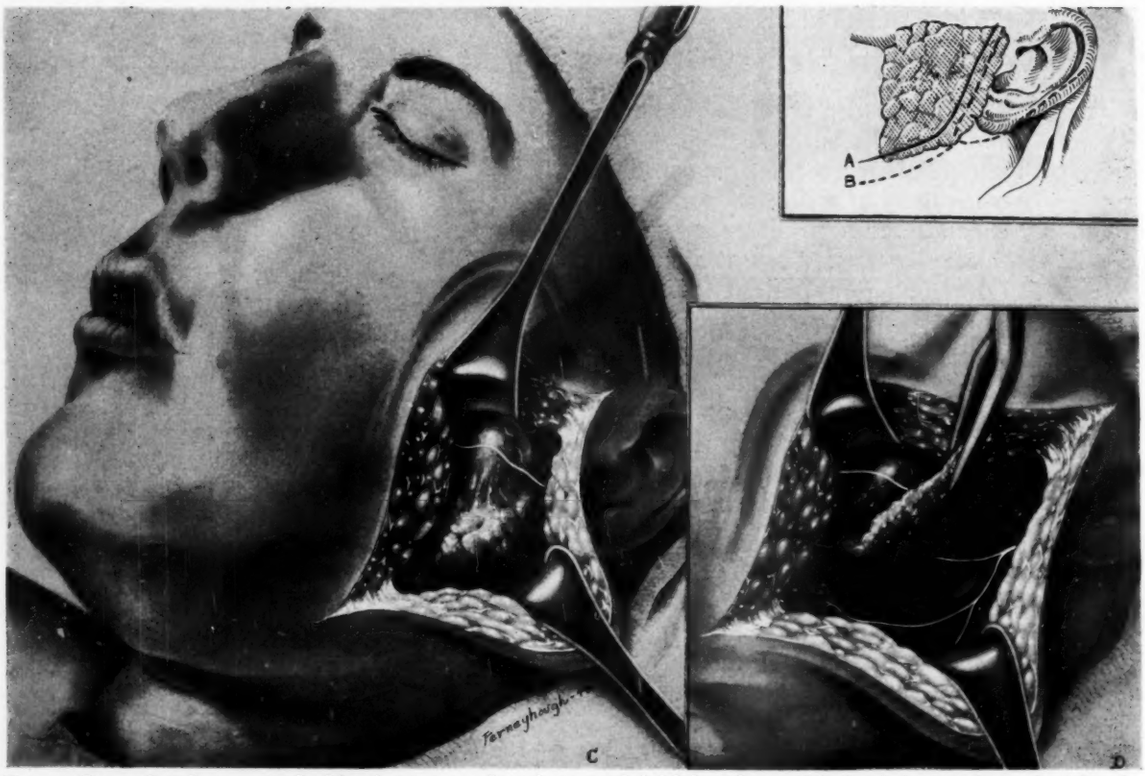


FIG. 4. Operation for removal of benign tumor deep in superficial lobe of parotid gland; insert shows incision for removal of benign tumors of the parotid gland. A, incision advocated by Blair and Patey; B, incision suggested by Sistrunk, Adson, Ott and Bailey; C, incision through skin and subcutaneous tissue that has extended down to the parotid gland; small branch of the facial nerve running over the surface of the tumor; this is unusual; D, method of demonstrating facial nerve; incision is carried along the lower edge of the mandible to the crossing of facial artery and vein. The mandibular branch of the facial nerve is found running parallel to the lower border of the mandible. (Redrawn from ADSON and OTT. *Arch. Surg.*)

Treatment. Mixed tumors are unresponsive to irradiation therapy. Treatment is complete surgical excision of the tumor with its capsule plus an area of tissue ½ to 1 cm. wide around it reducing recurrence to a minimum. Some authors[31,34,42] report recurrences of 35 or 40 per cent which is probably due to inadequate removal, the inexperienced operator being fearful of salivary fistula and injuring the facial nerve. The high percentage of recurrence with the knowledge that malignant transformation occurs in 10 per cent should impress the surgeon of the need for thorough excision of all tumor-bearing tissue. Metastasis from malignancy occurring in mixed tumors is slow, the mortality being about 6 to 10 per cent;[47,58] therefore, 90 to 94 per cent of malignant mixed tumors are curable by radical surgery. These facts in the past apparently have not impressed the occasional operator of the necessity of radical excision to prevent the high percentage of recurrences of both mixed and malignant tumors. A carefully planned surgical procedure should not injure the facial nerve when a benign tumor is being removed.

A radical operation is imperative for malignancy of the parotid gland, the patient being informed that the facial nerve will probably be partially or completely sacrificed along with removal of the node-bearing tissue. The cure of the patient and relief of pain far outweighs paralysis of one side of the face. The patient is apprized of these factors before operation but is assured that the insertion of fascial strips at the primary operation or, preferably, at a later date will improve to a greater or lesser extent the amount of disfigurement by lifting the angle of the mouth and the lower eyelid. If a malignant lesion has been neglected and is so extensive that a surgical measure will not reasonably effect a cure, irradiation is used for palliation.

Pentothal® sodium intravenously together with nitrous-oxide-oxygen anesthesia by intra-

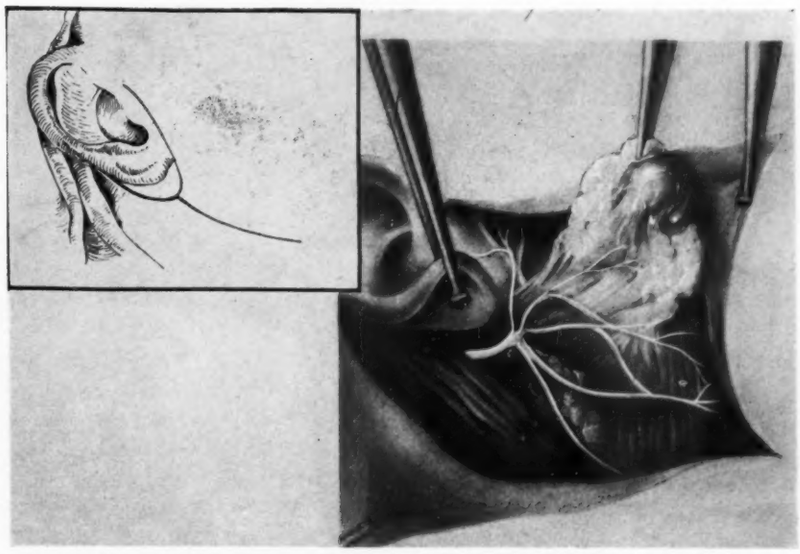


FIG. 5. Operation for removal of benign tumor of lower pole of superficial lobe of parotid gland; insert shows incision, as advocated by Sistrunk, Adson, Ott and Bailey, care being exercised to make the angle of the V-shaped incision an obtuse one to prevent necrosis. The isthmus of the gland is shown extending around the mandible to retromandibular lobe. (WARD, G. E. and HENDRICK, J. W. Tumors of the Head and Neck. Baltimore, 1950. Williams & Wilkins Co.)

tracheal inhalation is the anesthetic of choice. The entire half of the face and neck are draped into the operative field, permitting constant observation of facial movements. Two general types of incisions are used for the surgical approach to the parotid gland; one, advocated by Sistrunk, Adson and Ott,[1] begins at the level of the zygomatic arch in front of the ear and extends downward around the lobe of the ear and back of the angle of the jaw. The second incision (Hamilton Bailey[3]) begins on the first below the lobe of the ear and extends backward at an obtuse angle to the mastoid process. The lower end of the incision extends downward and forward about 2 cm. below the mandible and paralleling its lower border to as far as the external maxillary artery and vein. The incision that Blair[6] and Patey[48] emphasize is similar to Sistrunk's as quoted by Adson and Ott. (Fig. 4.)

After the skin incision is made, the facial nerve or one of its branches is identified at one or two convenient locations. The inframandibular branch emerges from behind the lower pole of the parotid gland and passes down behind the angle of the jaw, turning upward over the mandible to cross the external maxillary artery and vein. The nerve can be picked up in this location and followed back beneath the superficial lobe of the parotid gland to the main trunk of the facial nerve. This technic was emphasized by Sistrunk, Adson and Ott. Hamilton Bailey suggests that the main trunk of the facial nerve be identified as it emerges from deep in the neck between the mastoid process and the capsule of the retromandibular lobe of the parotid. After the main trunk is identified, it can be followed to where its branches separate and pass around the isthmus of the parotid; occasionally filaments of the nerve will be observed passing through the isthmus. After identification of the facial nerve the dissection is extended downward along the anterior border of the sternomastoid muscle. The external carotid artery is identified and ligated, reducing hemorrhage in the operative field and assisting in the continued identification of the nerve and its branches.

The main branch of the nerve or the inframandibular branch is definitely identified, the lower pole of the parotid gland is lifted up and the exact position of the tumor determined. The relationship of the facial nerve and its branches depends on the location of the tumor in the gland. If the tumor has its origin in the superficial lobe, as a rule, it will lie over the nerve and may depress it tightly against the masseter muscle. (Fig. 5.) If the tumor begins

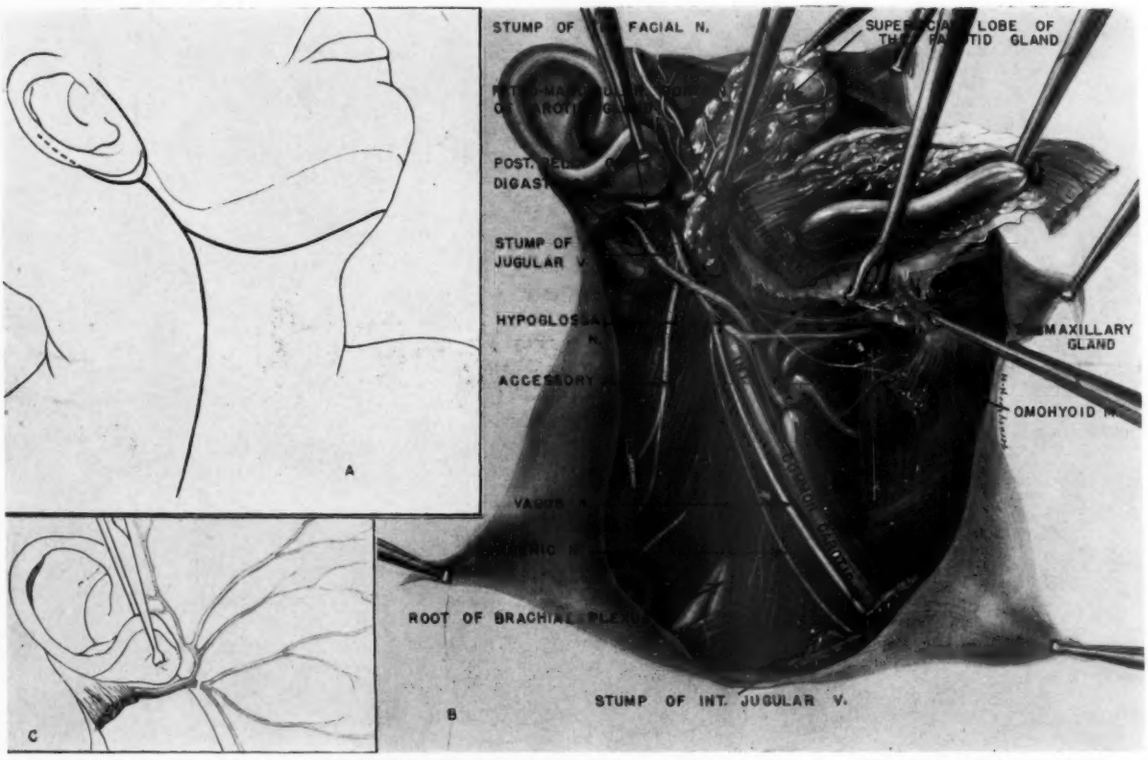


FIG. 6. Radical removal of parotid gland and radical neck dissection for carcinoma. A, incision begins at the level of the zygomatic arch in front of the ear and extends downward around the lobe of the ear. A second incision begins at the mastoid process and extends down to join the first at an obtuse angle and is continued downward parallel and below the mandible to the midline of the chin. A third incision is dropped vertically across the sternomastoid muscle to the middle of the clavicle. B, skin flaps are dissected back together with the platysma muscle. C, if possible the zygomatic and infraorbital branches of the facial nerve are left to avoid paralysis of the eyelids. If involved in the tumor the entire facial nerve is removed. (WARD, G. E. and HENDRICK, J. W. Tumors of the Head and Neck. Baltimore, 1950. Williams & Wilkins Co.)

in the retromandibular lobe or the isthmus, the nerve is pushed forward and is encountered running over the tumor itself. Tumors located under the lobe of the ear are better exposed by elevating the tragus of the ear with sponge forceps.[3] Tumors that involve the retromandibular lobe are sometimes removed with difficulty. A helpful maneuver is to rotate the head to the opposite side and elevate the angle of the mandible, which permits dislodging the tumor and increasing the working space. The facial nerve can be retracted by passing umbilical tape around it and its branches. The lobe is then separated from the internal carotid artery, internal jugular vein and pharyngeal wall. Bleeding will be of venous character as previous ligation of the external carotid artery reduces arterial bleeding. Occasionally larger tumors of the deep lobe will be literally stuck; having an assistant place his finger in the patient's mouth, making pressure over the lateral pharyngeal wall, exercising care not to injure the pharyngeal wall facilitate their removal.

The galvanic current stimulator has been of value in identifying branches of the facial nerve when the main trunk was not readily exposed because of the size of the tumor or adhesions from previous operative procedures. This is of particular value when there is a dense bed of adhesions obscuring the smaller filaments of the nerve. The electrodes of the galvanic current stimulator are sterilized along with the instruments and can be kept in the operative field for use when desired. Any unidentified tissue can be touched with the electrode, producing muscle contractions if nerve tissue is present. If accidently severed the cut ends of a nerve are repaired with fine vitallium® suture material.

Recurrent tumors that have the appearance of malignant transformation, or a primary tumor that is clinically malignant, should have

a biopsy to guide the planning of a more radical operative procedure. Biopsy is safe and any theoretic danger of spreading disease is outweighed by the value of an accurate diagnosis. Frequently it is difficult for the experienced pathologist to interpret accurately a frozen section of salivary gland tissue. We therefore believe that it is best to wait for a permanent section, allowing sufficient time for an accurate pathologic diagnosis. The clinical picture is also taken into consideration in evaluating the benignity or malignancy of a tumor. If a malignant tumor is present, a more radical procedure is necessary than when even large benign tumors are encountered. It is our experience that the whole[3,25,52] parotid gland should be removed together with a radical neck dissection in the management of all malignant tumors. Complete removal of the parotid gland when involved by cancer frequently necessitates sacrifice of the facial nerve or some of its branches. If it is possible to save the temporal and zygomatic divisions the eye is protected by not paralyzing the lid.

Technic for Operation for Malignancy of the Parotid Gland. The patient is prepared for a radical neck dissection together with the removal of the entire parotid gland. One of the two incisions described previously is extended downward parallel and below the mandible to the middle of the chin. A second incision is dropped vertically from the middle of the first (Fig. 6) down across the sternomastoid muscle to the middle of the clavicle. The skin flaps together with the platysma muscle are dissected back on all sides. The lower end of the sternomastoid muscle is severed between clamps. Bleeding points are controlled with electrocoagulation or by ligature.

The jugular vein is isolated just above the clavicle, ligated with four silk ligatures and severed between the two central ones. The dissection is carried up the neck, removing the sternomastoid muscle, jugular vein, the omohyoid muscle and lymphatic-bearing fascia from the clavicle to the mandible and from the midline in front to the border of the trapezius muscle posteriorly. The spinal accessory nerve is located as it emerges at the posterior edge of the sternomastoid muscle at about the junction of the upper and middle third and followed through the muscle to the upper end of the jugular vein. The sternomastoid muscle is severed at its origin on the mastoid process. The muscles and overlying lymph node–bearing fascia and parotid gland are now dissected upward and forward, protecting the spinal accessory nerve to where it dips beneath the posterior belly of the digastric to lie along the jugular vein. The posterior belly of the digastric muscle and the stylohyoid muscle are severed from their attachments to the digastric groove of the mastoid process and the styloid process, respectively. The upper end of the jugular vein is exposed by this maneuver and is separated from the spinal accessory nerve, ligated with four silk ligatures and severed between the two central ligatures.

Attention is next directed to the submaxillary gland and the submaxillary triangle, its contained lymphatics being dissected free from front to back. The submaxillary duct is ligated and severed and the dissection continued backward to reach the already dissected posterior neck. The neck has now been dissected from the midline in front to the trapezius muscle posteriorly and from the clavicle to the jaw; the dissection is then extended upward to include the entire parotid gland. The facial nerve is identified after it emerges from the stylomastoid foramen and as it divides to surround the isthmus of the parotid gland. Adherent carcinomas require sacrificing all branches of the facial nerve. As the dissection is carried forward, the retromandibular lobe is removed from behind the mandible and the superficial lobe from off the masseter muscle. If the ascending ramus of the mandible or any portion of the masseter muscle or the skin over the tumor are involved, all should be removed with the parotid gland *en bloc*.

The wound is closed in layers with interrupted fine silk. When much skin is sacrificed, grafting is necessary. Dead space is obliterated by tacking the flaps down to the neck. Drainage is effected with two Penrose drains, one brought out at the lower end of the neck incision and the second placed from behind the ear to emerge in the midline under the chin.

The necessary operative procedure for malignancy of the parotid gland usually results in injury or removal of a part or all of the facial nerve. Immediate care should be exercised to protect the muscles to avoid overstretching, resulting in permanent disfigurement of the face. This is accomplished by inserting a hook in the corner of the mouth fastened to a strap attached to a band around the head. The

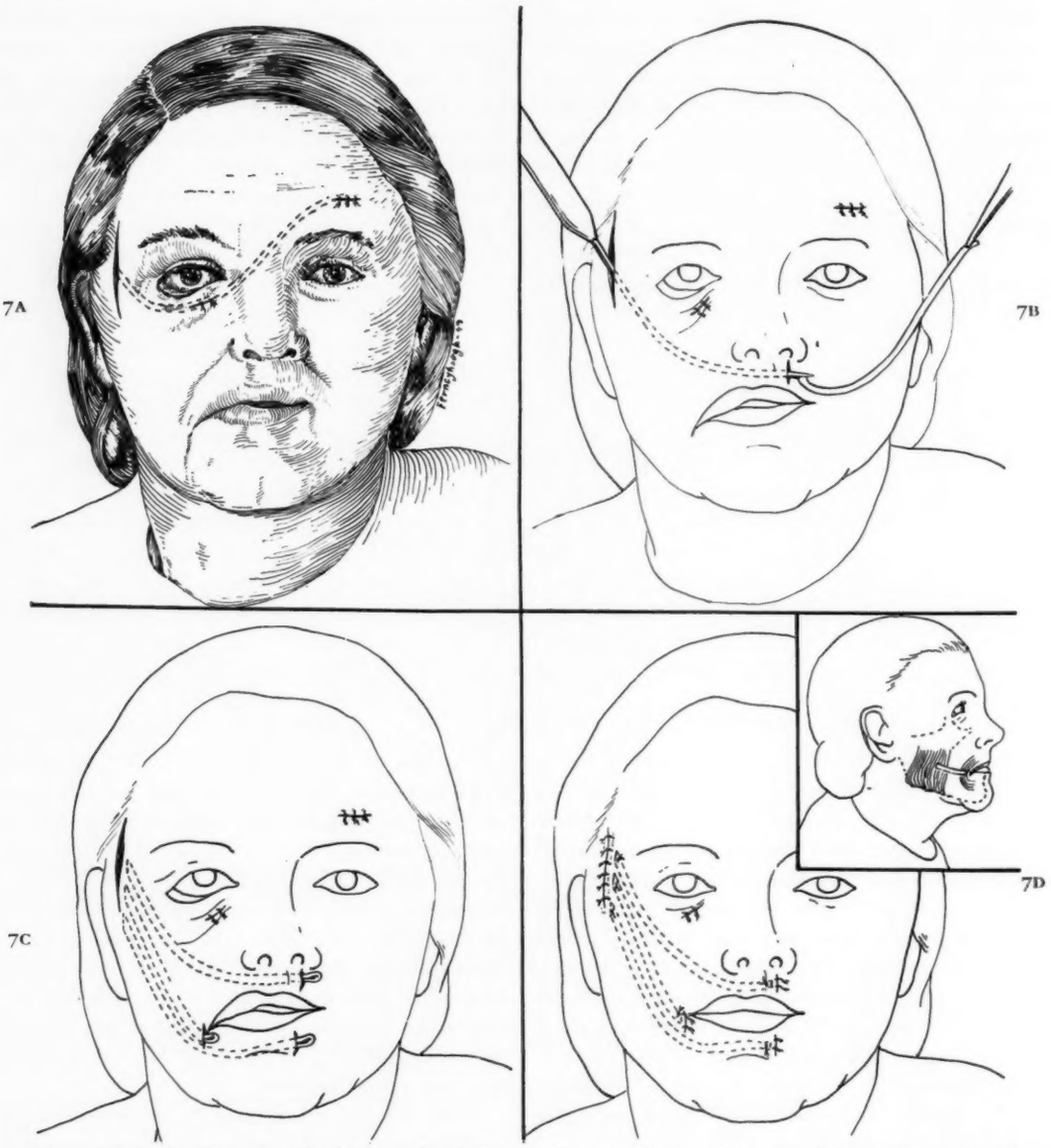


FIG. 7. Technic of repair of facial nerve injuries (Blair-Davis-Kitlowski). A, incision in front of helix of ear parallel to concha to ½ inch in hairline, exposing the temporal fascia. If there is marked redundancy of the skin due to old facial paralysis, the skin is undercut about 1.5 cm. to the zygoma. An incision is made in wrinkle line over the left frontal area about ½ inch above the eyebrow. An incision is made near the inner canthus of the eye to facilitate the passage of fascia. The fascia is threaded on a fascia needle which is passed subcutaneously beginning at the temple incision and coming out of the incision near the inner canthus. The needle is then reinserted, care being taken not to include the skin, and passed subcutaneously over the root of the nose to emerge in the incision over the eyebrow. The needle is then reinserted in the incision deeply enough to include some of the frontalis muscle and passes back subcutaneously through another channel to emerge from the incision at the inner canthus. The needle is then reinserted in this incision and passed back subcutaneously to emerge at its origin in the incision in the temporal fascia. The two ends of the fascia are caught with clamps. The incisions above the eye and the canthus are closed with nylon sutures. The ends of the fascia are pulled tightly, overcorrecting the eyelid. The fascia is then passed through the temporal fascia and tied in a knot with a suture through the knot. B, an incision is made beyond the midline of the lip ¼ inch long, mid-way from the floor of the nostril and the vermillion border of the lip. The fascia needle is passed from the temporal incision subcutaneously to the lip incision and then threaded with fascia and drawn back out through the temporal incision. The other end of the fascia is threaded on the fascial needle which is passed through the lip incision and through the

corner of the mouth is pulled up, overcorrecting the affected side. The apparatus is worn by the patient at night for a period of three to six months before correction is attempted.[35] After permitting a reasonable period of time to assure against recurrence, correction is essential for cosmetic appearance and also for protection to the eye. In facial nerve paralysis the lower lid drops away from the eye; the eye cannot wash itself by blinking and dust and infection enter the conjunctival sac. This is true particularly while the patient is asleep. Corneal ulcers may result with loss of the eye.

The Blair-Davis-Kitlowski[6,16,34] method of correcting facial paralysis is utilized with good results. Fascia is removed from the thigh with a fascia stripper. Preserved fascia tends to stretch and separate into fibrous bands, consequently it is not as satisfactory as fresh fascia, which remains as such, giving the best fixation. (Fig. 7A to 7D.) There is a reasonable amount of edema for a period of two or three months following fascial repair. The fascial bands act as barriers for the free drainage of lymph of the face. The edema gradually disappears giving the patient a satisfactory appearance when at rest.

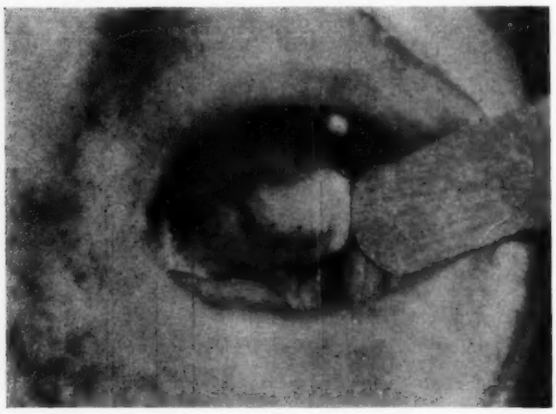
TABLE IV
TUMORS OF ABERRANT SALIVARY TISSUES

Location	Type of Tumor	Size (cm.)	Duration	Age at Onset (yr.)
1. Hard palate, left	Mixed cell tumor	2	4 yr.	44
2. Hard palate, left	Mixed cell tumor	1	3 yr.	12
3. Hard palate, left	Mixed cell tumor	3	25 yr.	8
4. Soft palate, right	Mixed cell tumor	3	20 yr.	35
5. Soft palate, left	Mixed cell tumor	3	10 yr.	16
6. Soft palate, midline	Mixed cell tumor	3 × 5 × 1	1½ yr.	28
7. Soft palate	Mixed cell tumor	Involved almost entire palate	1½ yr.	29
8. Above left eyebrow	Mixed cell tumor	1	1 yr.	45
9. Upper lip, left	Mixed cell tumor	1.7 × .8	2 yr.	43
10. Lower lip, left	Mixed cell tumor associated with hemangioma	3 × 2	4 yr.	37
11. Cheek	Mixed cell tumor	3 × 4	4 yr.	40
12. Behind right ear	Mixed cell tumor	1 × 1.5	8 mo.	
13. Cheek below left eye	Embryonal carcinoma arising from salivary tissue	2 × 2	6 mo.	⅔
14. Cheek below right eye	Embryonal carcinoma	2 × 1.5	2 mo.	1
15. Wall of right nostril	Embryonal carcinoma	1 × 2	1 yr.	1½
16. Right lateral pharyngeal wall	Sarcoma arising from mixed tumor	.....	5 yr	39
17. Pharyngeal wall	Sarcoma arising from mixed tumor	4 × 5	10 mo.	60
18. Mastoid process of temporal bone	Carcinoma arising from salivary tissue	3 × 2	10 mo.	54

Submaxillary Gland Tumors. Benign tumors involving the submaxillary glands are removed by total excision of the entire gland through an inframandibular incision. The gland is as a rule readily dissected free. Large calculi found in the neck portion of Wharton's duct or in the substance of the gland itself requires complete excision of the gland.

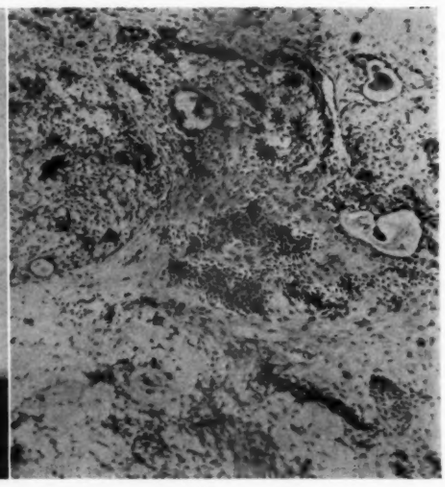
Malignant tumors of the submaxillary gland

orbicularis oris muscle and cheek muscles to emerge through the incision in the temple. The two ends are threaded on fascia needles and sutured through the temple fascia. C, in like manner a loop of fascia is passed to the corner of the mouth and another one in the lower lip beyond the midline. These are also tied and the knot secured after overcorrection. D, wounds closed with nylon sutures; insert shows loop of fascia passed from the corner of the mouth into the masseter muscle. This is designed to give some expression to the corner of the mouth by utilizing the active masseter muscle. If there is redundancy, some of the skin around the temple wound is removed. (WARD, G. E. and HENDRICK, J. W. Tumors of the Head and Neck. Baltimore, 1950. Williams & Wilkins Co.)



8A

8B



8C

FIG. 8. Mixed tumor, aberrant salivary tissue, involving soft and hard palate. A, a nodular, firm tumor that involves most of the hard palate on the left side from the soft palate to the alveolar ridge. B, defect after electrosurgical removal; patient has worn a prosthesis and has been well for over ten years. C, photomicrograph showing strands and nests of epithelial cells, hyalinized connective tissue.

require excision of the gland together with radical neck dissection as described previously except for removal of the parotid gland. The dissection extends from the clavicle to the mandible and from the midline in front to the trapezius, including the anterior and posterior triangles and the submaxillary triangles. The inframandibular branch of the facial nerve is preserved if possible.

Tumors of Aberrant Salivary Tissue. Aberrant salivary tissue may be present in the palate, cheeks, lips, nares, pharynx[20] and skin of the face and neck. Since salivary gland tissue arises from outgrowths of the primitive oropharynx, it is obvious that aberrant salivary gland tumors can be found in the aforementioned locations. (Table IV.) The two theories explaining the occurrence of aberrant salivary tissue tumors are (1) Cohnheim's[13] theory of embryonic rests and (2) the phenomenon of metaplasia,[65] i.e., the reversion of the epithelium in a given area to one of the primitive types.

Aberrant salivary gland tissue tumors are of interest in their differential diagnosis and treatment; they are surgical problems and irresponsive to irradiation. When found in the skin they appear as intracutaneous nodules with no special diagnostic characteristics. We have had numerous salivary gland tissue tumors of the soft and hard palate and upper alveolus but none in the mandible.

Aberrant salivary tissue tumors occurring in the soft and hard palate or alveolus are cystic

or firm in consistency. If cystic frequently there is a history of repeated aspiration with prompt recurrence of the mass. Like aberrant tissue located elsewhere these tumors more frequently undergo malignant change than tumors encountered in salivary tissue in its normal habitat.

A differential diagnosis can be made accurately only by microscopic examination. In the mouth the main characteristics that differentiate these tumors from others are (1) their slow growth, (2) their nodularity, (3) slowness in ulceration, (4) lack of pain and (5) epithelization of the tumor after biopsy. The latter characteristic is similar to adamantinoma; the epithelium grows over it quite promptly, which is in contradistinction to carcinoma or other malignant tumors which vegetate through biopsy incisions.

Treatment. Aberrant salivary tissue tumors of the soft and hard palate are removed by surgical excision (either electrosurgical or scalpel). The mucous membrane around the tumor is incised and the tumor enucleated. Most of the cases involving the palate in our series have occurred at the junction of the soft and hard palate or on the hard palate itself. Several invaded the antrum, which necessitated electrosurgical resection of the upper alveolus, giving a wide margin. It is imperative that all tumor tissue be removed with as little mutilation as possible; any adherent spots are carefully destroyed with electrocoagulation. Defects left by such resections can be closed with a prosthesis, permitting the patient to eat, drink, and talk with normal functional activity. (Fig. 8A and 8B.)

Large defects resulting from removal of extensive tumors are covered by a temporary prosthesis, carrying obturators of soft acrylic or soft rubber. Such prostheses are worn until the edges of the wound are well healed, when a firmer permanent prosthesis is used. When such an operative procedure is contemplated, an impression of the upper jaw is prepared in advance by the dental department. A stone cast is made of the impression and the approximate outlines of the operation are drawn permitting the prosthodontist to prepare the prosthesis and insert it immediately after operation.

REFERENCES

1. Adson, A. W. and Ott, W. O. Preservation of the facial nerve in the radical treatment of parotid tumors. *Arch. Surg.*, 6: 739, 1923.
2. Alezais and Bricka. Le cartilage à cellules ramifieés des tumeurs parotidiennes. *Compt. rend. Soc. de biol.*, 64: 380, 1908.
3. Bailey, Hamilton. The treatment of tumors of the parotid gland with special reference to total parotidectomy. *Brit. J. Surg.*, 28: 337, 1941.
4. Benedict, E. B. and Meigs, J. V. Tumors of parotid gland. *Surg., Gynec. & Obst.*, 51: 626, 1930.
5. Blady, J. V. and Hocker, A. F. Sialography—its technique and application in the roentgen study of neoplasms of the parotid gland. *Surg., Gynec. & Obst.*, 67: 777, 1938.
6. Blair, V. P. Operative correction of facial palsy. *Southb. M. J.*, 19: 116, 1926.
7. Blair and Byars. Diseases of salivary glands. In: Lewis. Practice of Surgery, vol. IV, chap. 5. Hagerstown, Md., 1924. W. F. Prior Co., Inc.
8. Borrmann. *Virchows Arch. f. path. Anat.*, 157: 297, 1899.
9. Carrieu. Note sur le développement des cellules ramifiées du cartilage des cephalopodes et de leurs rapports avec certains éléments des chondromes. *Compt. rend. Soc. de biol.*, 8 s. v: 577, 1888.
10. Chevassu, Maurice. Tumeurs de la gland sous-maxillaire. *Rev. de chir.*, 41: 145, 1910.
11. Clementz, H. Ueber das Schleimgewebe in Parotisgeschwulsten. Inaug. Dissert., Bonn, 1882.
12. Collet, Andre. Des tumeurs mixtes des glandes salivaires des levres. These de Paris, no. 277, 1895.
13. Cohnheim. *Virchows Arch. f. path. Anat.*, 68: 547, 1876.
14. Cuneo and Veau. Sur l'origine branchiale des tumeurs mixtes cervicofaciales. branchiomes cervico-faciaux. *Cong. Internat. de med., chir., Paris*, 10: 278, 1900.
15. Curtis and Phocas. Contribution a l'etude des tumeurs mixtes de la parotide. *Arch. prov. de med.*, 1: 7, 1899.
16. Davis, J. S. Plastic Surgery, p. 238. Philadelphia, 1919. P. Blakiston's Sons.
17. Delamere, Poirier and Cuneo. Anatomy of the Lymphatics. Translated by Leaf, C. H. Fig. 94, p. 250. Chicago, 1904. W. T. Keener & Co.
18. Degen, W. Ein doppelseitiges Sarkom der parotis. Inaug. Dissert., Freiburg, 1900.
19. Ehrich. Zur Kenntnis der Speicheldrusentumoren. *Beitr. z. klin Chir.*, 51: 368, 1906.
20. Ewing, James. Neoplastic Diseases, p. 730. Philadelphia, 1922. W. B. Saunders Co.
21. Foote, F. W. and Becker, W. F. Muco-epidermoid tumors of the salivary glands. *Ann. Surg.*, 122: 820, 1945.
22. Foot, N. Chandler. Pathology in Surgery, p. 481. Philadelphia, 1945. J. B. Lippincott Co.
23. Fry, R. M. The structure and origin of the mixed tumors of the salivary glands. *Brit. J. S.*, 1927, xv, 291.
24. Furstenberg, A. C. The parotid gland. *J. A. M. A.*, 117: 1594, 1941.
25. Harris, P. N. Adenoma of the salivary glands. *Am. J. Cancer*, 27: 690, 1936.
26. Idem. Adenocystoma lymphomatosum of the salivary glands. Report of two cases. *Am. J. Path.*, 13: 81, 1937.

27. Hertzler, A. E. Surgical Pathology of Diseases of Head and Neck, p. 171. Philadelphia, 1934. J. B. Lippincott Co.
28. Hinsberg, V. Beitrage zur Entwickelungsgeschichte und Natur der Mundspeicheldrusengeschwulste. *Deutsche Ztschr. f. Chir.*, 51, 281, 1899.
29. Houck, J. W. Tumors of salivary glands; review of prognostic data from literature. *Surgery*, 6: 550, 1939.
30. Janes, R. M. The treatment of tumors of salivary glands by radical excision. *Canad. M. A. J.*, 43: 554, 1940.
31. Kaltschmied, C. F. Tumors scirrhoso trium cum quadrante librarum glandulae parotids extirpato. Vienna, lit. Tennemannianis, 1752.
32. Kaufmann, C. Das Parotis-Sarkom pathologisch-anatomisch und klinisch bearbeitet. *Arch. f. klin. Chir.*, 26: 672, 1881.
33. Kennon, R. Tumours of the salivary gland. *Brit. J. S.*, 9: 76, 1921.
34. Kitlowski, E. A. Personal communication.
35. Krompecher, E. Zur Histogenese und Morphologie der Mischgechwülste de Haut, sowie der Speichel- und Schleimdrüsen. *Beitr. z. path. Anat. u. z. allg. Path.*, 44: 51, 1908.
36. Kuster, F. *Arch. f. klin. Chir.*, 12: 596, 1871.
37. Lederman, M. Mucous and salivary gland tumours. A report on a series of 57 cases with special references to radium treatment. *Brit. J. Radiol.*, 14: 329 and 368 (Part II), 1941.
38. Levin, Isaac. Pathogenesis and radium therapy of mixed tumors of the salivary glands. *Radiology*, 34: 69, 1940.
39. Longcope, Warfield T. Sarcoidosis or Besnier-Boeck-Schaumann disease. *J. A. M. A.*, 117: 1321, 1941.
40. Lowenkron, Hans. Ueber Entwicklung des Bindegewebes der grossen Mundspeicheldrusen (bei menschlichen Embryonen). *Ztschr. f. Anat. u. Entwicklnsgesch.*, 93: 370, 1930.
41. McFarland, Joseph. The mysterious mixed tumors of the salivary glands. *Surg., Gynec. & Obst.*, 76: 23, 1943.
42. McFarland, Joseph. Ninety tumors of the parotid region. *A. J. M. Sc.*, 72: 804, 1926.
43. McFarland, Joseph. Three hundred mixed tumors of the salivary glands of which 69 recurred. *Surg., Gynec. & Obst.*, 63: 457, 1936.
44. Moral, Hans. Ueber die ersten Entwickelungsstadien der Glandula parotis. *Anat. Hefte*, 48: 383, 1913.
45. Nasse, D. Die Geschwulste der Speicheldrusen und verwandte Tumorendes Kopfes. *Arch. f. klin. Chir.*, 44: 233, 1892.
46. Oden, Constantine. Papillary cystadenoma lymphomatosum of the parotid gland. *Am. J. Surg.*, 30: 57, 1935.
47. Pack and Livingston. Treatment of Cancer and Allied Diseases, vol. 1, p. 491. Chapter by Ahlborn, H. E. New York, 1940. Paul B. Hoeber, Inc.
48. Patey, D. H. Mixed tumors of salivary glands. *Brit. J. Surg.*, 18: 241, 1930.
49. Idem. Treatment of mixed tumors of the parotid gland. *Brit. J. Surg.*, 28: 29, 1940.
50. Pitance, J. B. Etude sur les tumeurs mixtes du voile du palais. These de Paris, no. 610, 1897.
51. Ribbert, M. W. H. Geschwulstlehre fur Aerzte und Studierende, p. 385. Bonn, F. Cohn, 1904.
52. Schridde, H. Ein rundzellensarkom der parotis. *Beitr. z. path. Anat. u. z. allg. Path.*, 34: 136, 1903.
53. Singleton, A. O. and Duren, Norman. Tumors of the salivary glands. *Texas State J. Med.*, 36: 784, 1941.
54. Stein, I. and Geschickter, C. F. Tumors of the parotid gland. *Arch. Surg.*, 28: 492, 1934.
55. Stewart, C. B. Management of parotid tumors. *Am. J. Surg.*, 30: 18, 1935.
56. Swinton, N. W. and Warren S. Salivary gland tumors. *Surg., Gynec. & Obst.*, 67: 424, 1938.
57. Virchow. Die Krankhaften Geschwulste. Berlin, 1863–1867. A. Hirschwald.
58. Volkmann, R. Ueber endotheliale Geschwulste, zugleich ein Beitrag zu den Speicheldrusen- und Gaumentumoren. *Deutsche Ztschr. f. Chir.*, 41: 1, 1895.
59. Wakely, C. P. G. Tumors of the salivary glands. *Surg., Gynec. & Obst.*, 48: 635, 1929.
60. Ward, G. E. and Hendrick, J. W. Tumors of the Head and Neck. Baltimore, 1950. Williams & Wilkins Co.
61. Wartmann. Untersuchungen über der Enchondrom. Inaug. Dissert., Strassburg, 1880.
62. Weishaupt, Elizabeth. Ein embryonaler Seitenganz des Ductus parotideus und seine Beziehungen zu einigen tumoren der parotis. *Arch. f. klin. Chir.*, 100: 542, 1912.
63. Wendell, A., Jr. Papillary cystadenoma lymphomatosum. *J. Cancer Research*, 14: 123, 1930.
64. Wood, F. C. The mixed tumors of the salivary glands. *Ann. Surg.*, 39: 57 and 207, 1904.
65. McWhorter, A. C. Quoted by Hamilton Bailey.[3]
66. Whitmore, Eugene R. The nature of metaplasia and malignant degeneration. *Bol. Liga contra el cancer*, 13: 263, 193.8

CARCINOMA OF THE PROSTATE*

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THE prevalent management of prostatic cancer is still new enough to warrant reporting and evaluating results. This article reviews experiences at the Guthrie Clinic for a five-year interval from July 1, 1943, to June 30, 1948. During this period 678 patients were treated for prostatic obstruction. Of this series 143 or 21 per cent were proved carcinomas. This number of prostatic malignancies represented .25 per cent of all admissions and 1.5 per cent of all male admissions above the age of forty-nine. For the same period carcinoma of the stomach was found in only 115 instances among males of this age limit. In the majority of reports gastric malignancies are most frequent cancers in men past fifty.

Diagnosis. Subjective symptoms were often misleading in making a diagnosis of prostatic cancer. The patients who reported with bladder neck obstruction associated with pain in hips and legs aroused a high degree of suspicion but frequently this distress was due to osteoarthritic changes which are so prevalent at this age. On the other hand, the aged patient with the same type of urinary distress accompanied with anemia and loss of weight and strength presented quite a clear diagnostic symptom complex. This picture occurred in the well advanced cases of malignancy.

We have been impressed with the precipitous onset of obstructive symptoms. This is in contrast to the gradually increasing difficulty in urination over a period of years in benign prostatic obstruction.

Digital examination remains our most reliable method of detection. Diagnosis was made in 130 patients in this manner. Cancer was not suspected after rectal examination in thirteen and the pathologic lesion was discovered on biopsy. This was among 678 patients operated upon for obstruction so the percentage of error was small.

On the other hand, malignancy was diagnosed preoperatively and proved benign in fourteen instances. The misleading impression resulted from cicatricial change with areas of induration.

In only two patients during this period under study had we found carcinomatous development following previous operation in which benign hypertrophy was diagnosed by histologic examinations. In one instance this occurred eight months following suprapubic enucleation and in the other two and one-half years following transurethral resection.

Since operations for benign prostatic hypertrophy do not remove the posterior lobe, it is surprising that more patients have not returned with carcinomas. This is particularly amazing since the remaining part contains the most potent carcinogenic elements. About 75 per cent of carcinomas allegedly start in the posterior lobe. To add further to the astonishment malignant niduses have been revealed in serial sections of supposedly benign glands in 20 to 85 per cent of those examined and reported by individual observers. One would expect a higher percentage of such areas in the posterior lobe. Of the large number of men who have submitted to the simple operation for the correction of prostatic obstruction, a relatively few appear to develop cancers postoperatively.

In obtaining tissue for biopsy during resection we singled out those pieces from the indurated portion of the gland where carcinoma was suspected. This could easily be accomplished with the Nesbit resectoscope and the O'Connor drape. With the rectal finger the tissue was readily identified and guided into the loop.

Blood sedimentation rates offered us very little in helping to arrive at a diagnosis of malignancy.

In the presence of a high serum acid phosphatase level there was no appeal from a diagnosis of carcinoma of the prostate. However, when this was found, other definite signs were usually present. Osteoblastic or osteolytic

* This paper was read before the Urologic Section of the American Medical Association at Atlantic City on June 10, 1949.

bone metastases were always a specific and positive sign.

Our experience with the stained smear of the prostatic fluid according to the Papanicolaou method has not been very extensive. In the few instances of the positive smear there was no question of the diagnosis before the examination of the fluid. We found no false positives but we did encounter several false negatives. (Table I.)

TABLE I
AGE INCIDENCE

Ages	No. Operated Upon for Obstruction	Malignancies Found	Per cent of Those Operated Upon	Per cent of Total —143
Under 40	...	1	....	....
40–50	23	5	21.7	3.5
51–60	90	14	15.5	9.7
61–70	237	42	18.1	30.0
71–80	234	61	26	42.5
81–90	71	20	29.3	14.0
90 plus	1	0	....	....

With one exception the age incidence of this group of 143 offered nothing unusual. In the patient under forty carcinoma of the prostate developed at an age when this type of malignant disease is considered rare. This man had a very large, completely obstructing prostate. At the time of the transurethral resection and bilateral orchidectomy he was bedridden. Following treatment he became ambulatory but had never regained adequate strength although he is still alive thirteen months later.

Between the ages of forty and fifty prostatic malignancy is uncommon. Here we have five patients representing 21.7 per cent of those operated upon for obstruction but only 3.5 per cent of the total of 143 discussed in this paper. Those in the next age limits show 15.5 per cent of these operated upon for obstruction and 9.7 per cent of the total. Between sixty-one and seventy there is a large increase in the number operated upon, with forty-two malignancies for a percentage of 18.1 and 30 per cent of the total number. Between seventy-one and eighty years sixty-one had carcinomas representing 25 per cent of those operated upon and 42.5 per cent of the total. The next age group had twenty cancers for a percentage of 29.3 of those operated upon and 14.9 per cent of the total.

From the percentages reported in Table II it appears that the older the man beyond fifty the greater the frequency of carcinoma of the prostate. The percentage of prostatic cancers among the admissions for the highest age group is thirty times that of the forty to fifty group, twelve times that of the next, four times the third number and one and one-half times the next highest age.

TABLE II

Ages	No. of Carcinomas	No. of Male Admissions	Per cent of Admissions
40–50	5	2361	.21
51–60	14	2749	.51
61–70	42	2463	1.7
71–80	61	1382	4.3
81–90	20	332	6.0

Prognosis. In Table III are listed sixty-six survivals and by a strange coincidence the same number who have died. Eleven could not be traced. Four of the original number operated upon during the first six months of the observation period are still living and three are still employed. Their ages are sixty-three, seventy-three, seventy-four and seventy-eight.

TABLE III
SURVIVAL TIME SINCE OPERATION

Months	Still Living	Dead
6		24
12	16	14
18	8	5
24	10	7
30	5	3
36	9	2
42	5	3
48	3	3
54	2	3
60	4	2
66	4	0
Average	27.8 mo.	18.8 mo.

Eighty-five per cent showed some benefit from the orchidectomy and 15 per cent proceeded to the terminal symptoms without any remission. We detected very little either in the symptoms, the physical examination, roentgen studies or biopsy of tissue removed at operation, which could give us any clue as to the

prognosis. The patient with minimal symptoms and no evidence of metastases frequently but not invariably experienced longer remissions. Those who returned with evidence of renewal of the progress of the disease after a satisfactory remission continued to go downhill with but short periods of remission, if any. This patient rarely lived as long as six months after the recurrence developed. This prognostic sign was particularly striking in the individual in whom evidence of bony metastases developed at the end of the remission where none had previously been observed at the time of operation.

TABLE IV

Age Group	No. Who Had Cancer		Average No. of Months of Survival	
	Living	Dead	Living	Dead
40–50	2	3	21	16
51–60	5	9	25	25
61–70	30	11	32.5	24.5
71–80	26	28	30	32
81–90	6	10	16	14

It is rather difficult to draw conclusions as to the prognosis from the age of the patient with carcinomatous disease of the prostate in such a modest series. The following table shows the average survival in months of the various age groups:

In the forty to fifty age group the number is too small to offer any significance. In this study the patients between sixty-one to seventy enjoyed the longest mean survival time.

Treatment. The therapeutic management did not vary during the entire period covering this report. Orchidectomy or estrogens were not used unless the carcinomatous prostate was obstructive, the patient was experiencing pain or there was definite evidence of metastases and/or the presence of a high serum acid phosphatase level. Patients with asymptomatic extensively indurated glands received no active treatment. They were kept under periodic observation and therapy was administered only if one of the aforementioned conditions developed.

To alter the androgen-estrogen balance to a more favorable status for the patient, we recommended orchidectomy invariably. However, in a few patients this was not carried out because of some preventing obstacle: the refusal on the part of the patient to submit or the physical condition not permitting.

Under such a regimen about 85 per cent of our patients experienced some degree of improvement varying for extremely different periods of time. In some this period of improvement and malignant suppression lasted for only a few months and in others the amelioration of symptoms extended over a space of years.

Three of our cases showed the papillary type of carcinoma resembling in microscopic appearance the transitional cell lesion of the bladder. These patients responded in a favorable manner to orchidectomy. The cell pattern of the carcinomatous prostate did not seem to make any difference in the response to hormonal therapy. None of these three patients showed any evidence of bone metastases and there was no increase in the serum acid phosphatase level.

Following orchidectomy no treatment was administered until there was recurrence of symptoms, at which time stilbesterol orally was prescribed. The dose varied with the effect and the tolerance of the patient. When this treatment eventually failed, roentgen therapy was administered. When pain was no longer controlled by any of the aforementioned methods, the patient was referred to the neurosurgeon for alcohol injection of the nerve roots or chordotomy. For a short period before the end many required opiates in gradually increasing doses.

SUMMARY

One hundred forty-three cases of carcinoma of the prostate are reviewed.

Palpation per rectum was the most reliable single method of diagnosis by physical examination. In only thirteen cases was the diagnosis of carcinoma of the prostate missed by this method.

Malignancy of the prostate is rare before the age of forty and increases in frequency among hospital admissions as the age of the male increases beyond fifty; from eighty to ninety its percentage of occurrence is thirty times that of the forty to fifty age group.

Prognosis is difficult to appraise except in the patients with recurrences; at that time the outlook is invariably poor.

SURGICAL TREATMENT OF HERNIATED LUMBAR INTERVERTEBRAL DISCS*

FOLLOW-UP STUDY OF 130 PATIENTS WITHOUT SPINAL FUSION

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THE herniated intervertebral disc syndrome has always been an orthopedic problem. It has become apparent in the literature of the past few years that orthopedic surgeons are taking a more active part in the surgical treatment of this condition. However, there is still considerable disagreement among surgeons in general and orthopedic surgeons in particular concerning the method of surgical treatment. Up to quite recently the majority of orthopedic surgeons insisted that spinal fusion was the only certain and adequate treatment of herniated intervertebral discs. In many centers the surgery of this condition is still a combined operation with the neurosurgeon excising the ruptured disc and the orthopedic surgeon performing the fusion. In other institutions the surgical treatment of the herniated intervertebral disc is left entirely in the hands of the neurosurgeon.

The necessity for spinal fusion in herniated discs has never been adequately proven except in the presence of spondylolisthesis. It is the purpose of this article to raise the question as to whether spinal fusion is necessary in the successful surgical treatment of the syndrome known as the herniated intervertebral disc.

The surgical treatment of herniated disc has been carried out upon the Orthopedic Service of the University Hospitals, Cleveland, for many years. The first operation at this institution for a herniated intervertebral disc was performed in 1932 by Dr. Maxwell Harbin. Unfortunately, the lesion was not recognized as such at that time, but the description of the lesion and the operative note are classic. However, the pattern had been set and after the diagnosis and surgical treatment of herniated intervertebral discs had become popularized by Dandy and other pioneers in disc surgery, the procedure carried out on this service during the ensuing years changed very little from that performed on the first patient by Harbin in 1932.

Only by adequate and thorough appraisal of end results can a procedure be properly evaluated. Therefore, an extensive end result study was made on an unselected number of patients treated with surgery on the orthopedic service of this hospital. Only patients one year or more postoperatively were asked to appear for examination. There were a total of 130 patients examined, each receiving a thorough physical examination and evaluation and also an x-ray examination of the lumbosacral spine. This was only about 50 per cent of patients treated with surgery for herniated intervertebral disc on the orthopedic service at University Hospitals, but many patients reported they were well and would not come in, others had moved and could not be followed and a large number were less than one year postoperative and were deliberately omitted from this study. The follow-up period postoperatively in this series ranged from one to ten years. The average postoperative period was three years and three months.

It would be wrong to infer that all patients suspected of disc lesions should be treated by surgical means. Indeed, it has been our experience that the large majority of patients will recover under a regimen of conservative treatment. Mild and less severe cases are seen regularly and most of these patients respond well to bed rest, a plaster body jacket, brace or reinforced corset. Most of these patients are never hospitalized. However, there are many cases that do require surgery and this study illustrates that a proper selection of patients and a relatively simple procedure can give excellent results. It may be noted that of the several hundred patients who have had removal of a

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herniated disc on this service, there has been no mortality.

ETIOLOGY AND INCIDENCE

It is not the purpose of this report to go into the theoretic aspects of intervertebral disc lesions. Suffice it to say that there is more or less general agreement that it is a degenerative lesion. However, the factor of trauma must definitely be considered. As illustrated in Table 1, of the 130 cases reviewed, ninety-three or 71.5 per cent were males and thirty-seven or 28.5 per cent were females. The age incidence was about equal for both sexes, the males ranging from twenty-two to sixty-three years with an average of thirty-nine years, whereas the females ranged from twenty-four to fifty-two years with an average of thirty-eight years.

TABLE 1
SHOWING FACTORS OF SEX, AGE, INCIDENCE AND TRAUMA

	No. of Cases	Per cent	Age Range	Average Age	No. of Cases with Trauma	Per cent
Male.....	93	71.5	22–63	39	51	56
Female.....	37	28.5	24–52	38	12	32
Total....	130	....	.....	..	63	48.5

Of the 130 cases there was an incidence of definite trauma in sixty-three or 48.5 per cent. In the majority of these cases related to trauma the patients stated that while doing heavy lifting or after a fall or other severe force upon the back, they felt a "snap" in the lumbar region with resultant back pain followed immediately or more often later with radiating pain down the back of the leg. In a few cases trauma was less severe when picking up a chair and bowling. Trauma was recorded as a factor only if there was such a definite incidence as referred to before and from which the patient dated all his back or leg symptoms. The fact that 56 per cent of the male cases revealed a history of trauma and only 32 per cent of the female lesions were related to trauma is further proof that trauma plays a definite role in these lesions. It is obvious that vocations of the male predispose to more trauma.

DIAGNOSIS

History. The history in disc lesions is of a rather definite pattern and this is especially true in this series of cases. Intermittent attacks of low back pain and radiating pain down one or both legs, with or without a history of trauma, was the usual complaint. In the more severe cases symptoms were constant until relieved by surgery. However, the large majority of patients had intermittent attacks. Many reported that they had tried different kinds of treatment elsewhere prior to surgery. This included conservative therapeutic measures, osteopathic and chiropractic manipulation, mechanotherapy and home remedies. One patient had even been hospitalized in a mental institution because of her persistent complaints. The duration of symptoms before surgery varied from two weeks to thirty years and the average length of time was three years and three months. Only fifteen patients were operated upon with less than three months' history. Most of these latter patients were completely incapacitated, not relieved at all by bed rest, and upon operation many were found to have a perforation of the posterior annulus with extrusion of disc material.

Close inspection of presenting symptoms and complaints in this series brought out the interesting fact that leg pain was present in every case. On the other hand, back pain was mild or minimal in ten cases. One had back pain following the onset of leg pain by three months and one case had never had back pain. This does not minimize back pain as a very important symptom but tends to stress the significance of radicular pain in the diagnosis of disc lesions, being present in 100 per cent in this series. This may also illustrate an excellent selection of cases.

Paresthesias were present fairly routinely, but pain was such a predominating complaint in these patients that very few volunteered paresthesias as a complaint. When asked specifically most patients had some degree of paresthesia in one or both legs or feet.

Examination. The diagnostic signs of lumbar spasm, limitation of forward and/or backward bending, and limitation of straight leg raising were present to a greater or lesser degree in practically every case. Excepting neurologic findings, these can be considered cardinal signs. Another sign which appeared to be of great value and which we have become accustomed to rely upon more and more was the frequency in which one found tenderness in the lower lumbar area associated with radiating pain down the leg upon pressure. Unfortunately,

this was not recorded in enough cases to give accurate statistics. Other tests such as the Naffziger jugular compression test, the gait, right and left lateral bending, deep calf and thigh hypersensitivity, tended to be useful adjuncts to diagnosis but were not as consistent as those mentioned previously.

diminished in 6.2 per cent of fourth space lesions, but the ankle jerk was completely gone in only one case of a fourth space disc, about 2 per cent. This illustrates the importance of the ankle jerk, for the loss of an ankle jerk was present in sixty-five per cent of fifth space lesions. An absence of both ankle jerks was not

TABLE II

ILLUSTRATING INCIDENCE OF LESIONS AT VARIOUS LEVELS AND PREOPERATIVE REFLEX CHANGES IN 116 CASES PROVEN BY SURGERY

Lesion	L 3–4		L 4–5		L5–S1		Double Lesions		
	No.	Per cent	No.	Per cent	No.	Per cent	L 3–4 L 4–5	L 4–5 L5–S1	
No change	1	50	37	77.1	13	20.6	...	1	
Absent knee jerk	1	50	2	4.2	..	....	...	...	
Diminished ankle jerk	..	..	3	6.2	4	6.3	...	...	
Absent ankle jerk	..	..	1	2.1	41	65.1	...	1	
Absent both ankle jerks	..	..	5	10.4	5	7.9	1	...	
Total cases	2	..	48	....	63	....	1	2	116
Site of lesion percentage	1.7		41.4		54.3		0.9	1.7	
							2.6		

The neurologic examination proved to be the most accurate for localization of lesions. Sensory changes were routinely present in these patients and the charting of areas of hypesthesia in a foot and leg as advocated by Keegan can give valuable information as to localization. However, we have not depended upon sensory changes for localization to a very great extent and therefore can give no accurate statistics. The presence of hypesthesia has been mainly considered as evidence of nerve root irritation in the same way that calf and posterior thigh hypersensitivity have been in the examination of these patients. The reflex changes have been the most reliable means of localization. Table II illustrates the relationship between the preoperative reflex changes and the location of lesions found at operation. Lesions above the fourth interspace are rare, but from the table one can expect to find an absent knee jerk in 50 per cent of the cases of a third space disc. No reflex changes at all are highly indicative of a lesion in the fourth interspace in that over 75 per cent of such lesions showed no reflex changes preoperatively. The ankle jerk was a very frequent finding and should not be relied upon for localization because this can occur in individuals with no pathologic process.

Myelography. No discussion of diagnosis is complete without the question of myelograms. We have not used contrast myelography as an eliminative diagnostic measure. We have tried to adhere to the policy of not doing myelograms unless surgery is contemplated. The greatest asset in myelogram studies is in ruling out tumors and double lesions. Double lesions are difficult to diagnose clinically and as illustrated in Table II occurred in 2.6 per cent of proven cases in this series. In questionable localization myelograms are of definite value if they reveal absolute positives in that the surgeon may save operative time by only exploring one space if the other spaces are all negative by myelography.

Myelograms were performed in fifty-nine of these patients. That this is a highly efficient procedure is illustrated in Table III. Of the fifty-nine studies only six were misleading. Four cases revealed defects by myelography, but no disc lesions were found at operation. One of

these cases, however, was a case of true hypertrophy of the ligamentum flavum, the only such diagnosis made in this entire series and this was made at the time of surgery. There were two occasions in which myelograms were concluded as negative, but upon exploration

TABLE III
RESULTS OF MYELOGRAPHY IN FIFTY-NINE CASES

	No.	Per cent
Successes		
Positive myelograms and positive surgical explorations including double lesions	49	83.0
Negative myelograms with negative surgical exploration	4	6.8
Failures		
Positive myelograms with negative surgical exploration	4	6.8
Negative myelograms with positive surgical exploration	2	3.4
Total number myelograms	59	....
Successful myelograms	53	89.8
Failures	6	10.2

typical ruptured discs were found. If we count these six cases as failures, this makes the procedure 90 per cent efficient. The importance of myelograms in double lesions is proven by the fact that there was absolute surgical confirmation of two double lesions on myelography. There were no myelogram studies performed on the third case of double lesion. Both cases which revealed a double lesion by myelogram were found to have double typical herniated intervertebral discs at operation. There were no false reports of double lesions. Four myelograms were completely negative and corroborated by negative surgical exploration in each instance.

There were eleven cases in which lipiodol was used as the contrast medium. This necessitated removal of the oil at the time of operation by opening the dura and aspiration. In the remaining forty-eight cases pantopaque was used. Even by using only 3 cc. of pantopaque for these studies, removal by aspiration at the time of myelography is not always successful and complete removal of the material is by no means the rule. However, the pantopaque tends to disappear from the subarachnoid space after a period of months or years.

The question of adhesions of the cauda equina following pantopaque myelography has been brought up many times. Adhesions have been found in cases in which the dura has been opened and whether it is the pantopaque or the surgical trauma to the dura which caused the adhesions is difficult to determine, but we have been left with the opinion that pantopaque remaining in the subarachnoid space may be a factor in adhesions of the cauda equina.

Spinal Fluid. The examination of the spinal fluid was grossly normal in every instance except one. Eighty patients had spinal fluid studies. In one case the fluid was xanthochromic and this case was atypical in that there was a complete flaccid paralysis of the lower extremities with loss of sphincter control. At operation this proved to be a complete block of the cauda equina due to a ruptured disc with very severe compression of all the nerve elements, the only such case in the entire series. The total protein determination of the spinal fluid in this case was 1,200 mg. Of the remaining seventy-nine cases the total protein was over 40 mg. in fifty-four instances and below 40 mg. in twenty-five cases. Excluding the very high elevation in the case described before the highest determination was 162 mg. The average elevation was 72 mg.

OPERATIVE PROCEDURE

The technic of laminectomy is familiar to everyone. It has been routine in all these cases to strip the spinous processes and laminas of soft tissues on both sides to give adequate exposure and not just on the suspected side. The ligamentum flavum also has been removed from the involved space or spaces in its entirety. In all the early cases it was routine procedure to remove the spinous process and one or both laminas. However, in the past few years this was not found necessary in every instance and in the majority of patients no bone or only a small portion of lamina was removed. Since 1947 we have termed such a procedure a laminotomy as being more descriptive of the actual operation.

In 1947 we began using the knee chest position; and although this has not been adopted by everyone on the service, thirty-two cases in this series were done in the knee chest position. The advantages are maximum widening of the interspinous space and performing the operation with little or no removal of bone. A great

disadvantage is increased tautness of the dura and nerve trunks thereby adding increased resistance to retraction. Another handicap is the inability to change the position of the patient at will. In the thirty-two cases in which the position was used, however, there were no operative complications and laminectomy was only necessary in two of these cases.

The treatment of the lesion itself has consisted of removal of as much as possible of the degenerated nucleus pulposus. In a few of the cases in which the posterior annulus had already been perforated and disc material had already extruded, simple removal of this material was done. This was only true, however, in those cases in which the interspace was so small as to prohibit the entrance of a curette and no more nucleus was readily available after the pieces had been removed. The lesions in this study were classified as herniated or ruptured. By herniation is meant that the posterior annulus is intact and the lesion appears as a dome-like mass encroaching upon the neural canal. The usual procedure was to make a stellate incision over this mass after the dura and nerve root had been retracted, remove the large fragments which extruded following incision and then remove as much nucleus as possible by means of curette or pituitary rongeur. By ruptured is meant perforation of the posterior annulus with protrusion or extrusion of disc material. There were twenty-three ruptured discs in this series and ninety-three herniated discs. As in any large series there were fourteen negative explorations, a percentage of 10.8. In those cases in which no disc was found it was the rule to do an adequate bony and ligamentous decompression. Negative exploration does not mean that the patient has not had or does not have a ruptured disc; but if this was not absolutely discernible at the time of surgery, multiple searching incisions of the interspaces were not considered warranted and were not done. Posterior decompression in such cases gave very satisfactory results. In some cases posterior decompression was also combined with removal of the herniated nucleus pulposus.

In surgical treatment of a herniated disc opening of the dura should be avoided if possible. Transdural removal of lesions was a fairly common procedure in the early days and there were seventeen such cases in this series. However, there has not been a transdural removal of a ruptured disc on this service in the past three years. In fifteen cases the dura was opened either accidentally or in order to remove lipiodol. We are convinced that opening the dura may cause adhesions and has led to another serious complication which will be elaborated upon later in this paper.

POSTOPERATIVE COMPLICATIONS

Postoperative complications other than those corresponding to surgical procedures of any other type or on any other part of the body have been few. However, twelve patients required reoperation, a percentage of 9.2 as indicated in Table IV. Two of these cases were of an unusual nature and should be discussed in further detail. Both were complicated by the formation of a spinal fluid cyst at the operative site. The first case was the transdural removal of a ruptured disc in a fifty-two year old man. The first few months following operation were uneventful, but he then began to have increasing back pain and shooting pains in both legs. There was also severe pain in the legs elicited upon pressure over the lower spine. Sixteen months after his disc operation he was re-explored and was found to have a large posterior spinal fluid cyst which was in communication with the dural canal by a small hole in the dura where it had been sutured following the transdural removal of the disc. The cyst was excised and the dura closed by continuous fine silk suture and the patient made an uneventful recovery. The second such complication occurred five years following the first in a forty-eight year old woman who had a laminectomy with removal of a ruptured disc but in which the dura was accidentally opened. This opening was only pinpoint and no larger than one would expect from a lumbar puncture needle. The escape of spinal fluid was so minimal that nothing was done. This patient's recovery was considered slow and she also began to have shooting pains in the legs and a definite "trigger" point in the lower back which upon pressure would send shock-like pains into both legs. At re-exploration two months later a similar large spinal fluid cyst was found, communicating with the dural canal through an opening no larger than a pinhead. The sac was excised, the dura sutured and the patient was considerably improved. As indicated in Table IV of the other ten cases which came to second operation six were for recurrence at the same space, one

for a ruptured disc at a higher level, one for extensive varices and two for adhesions. The six recurrences, a percentage of 4.6, stresses the importance of removal of as much of the nucleus as possible.

TABLE IV
FINDINGS IN SECOND OPERATION IN TWELVE PATIENTS

	No.	Per cent
Recurrence of herniated or ruptured disc at same space	6	4.6
Herniated disc at a higher level	1	0.8
Spinal fluid cyst	2	1.5
Adhesions	2	1.5
Varices	1	0.8
Total number of cases requiring second operation	12	9.2

Prolonged bed rest following operation had been avoided in all these patients. The average number of days in bed postoperatively was nine days in the total 130 cases. Early ambulation is not contraindicated in most instances and is desirable. In some of the recent cases patients have been allowed out of bed the day following surgery.

PATIENT FOLLOW-UP

There was no selection of patients for follow-up examination. All those who were one year or more postoperative were requested by letter to appear for examination. To give a fair evaluation this included cases in which no ruptured discs were found as stated before. Of the 130 patients examined, all had returned to some kind of work except the patient who had had the complete paralysis prior to operation. However, this patient had improved considerably six years after operation and was able to get about with the aid of braces and a cane. Excluding this latter patient, no one wore a brace or had any difficulty in ambulation and no patient was incapacitated in any way.

Subjective complaints were very few and the patients appeared eager to demonstrate how well and happy they were. Upon close interrogation of symptoms about 50 per cent of patients admitted that they occasionally would have some back discomfort or perhaps mild leg pain, especially if they did arduous labor or heavy lifting. None of them felt the need for further treatment.

There was limitation of motion of the spine in only five patients. All patients walked well and not a single back was considered to be unstable.

TABLE V
ABILITY OF PATIENT TO RETURN TO WORK FOLLOWING OPERATION; FOLLOW-UP ON 130 PATIENTS*

	No.	Per cent
Total number of patients able to return to some kind of work	129	99.2
Total number of patients able to return to same work	118	90.8
Total number of patients who returned to different kind of work	11	8.4
Number of patients unable to return to work at all	1*	0.8

* Patient had complete paraplegia prior to operation.

When asked outright upon the degree of improvement after operation on a percentage basis, 113 patients or 87 per cent reported 100 per cent improvement, eleven or 8.4 per cent reported 75 per cent improvement and 6 or 4.6 per cent reported 50 per cent improvement. Not a single patient thought that he was unimproved following operation.

Ability to work and earn a livelihood is one of the best gages of an individual's fitness. Very few lesions can be as disabling as a herniated intervertebral disc. Most of these patients had to leave their work because the pain was no longer endurable. Therefore, the return to work was considered one of the most important factors in the survey of these patients. Table v illustrates the statistics. Of the 130 cases, 118 or 90.8 per cent returned to the same work which they were accustomed to doing before the onset of their disability. Of the twelve patients who did not return to the same work, four nevertheless claimed 100 per cent improvement, whereas the remaining eight patients claimed 50 to 75 per cent improvement. This series included a moderate number of compensation cases.

The average length of time before return to full work was only two months as established in the follow-up of these patients. This is in sharp contrast to the economic loss and long period of disability following a spinal fusion.

The patients examined were from all walks of life, from those doing very heavy labor to those who were fortunate enough to live a life of leisure.

In order to establish the residual effects of disc surgery, neurologic objective tests were made as well as x-ray examination of the lumbar spine. Measurement of reflexes in follow-up examination revealed that the return of lost reflexes is the exception rather than the rule. This is well illustrated in Table VI. In the two instances in which the knee jerk was lost, there was complete return in both cases. However, of fifty-eight patients in whom there was loss of ankle jerk there was return in only fourteen or 24 per cent. There were also eight patients in whom there was the additional loss of an ankle jerk in the opposite leg or a bilateral absence following operation. That operation itself can be responsible for permanent nerve root change is illustrated by the fact that of fifty-nine patients who had no reflex changes prior to surgery, nineteen or 32 per cent had the loss of both ankle jerks postoperatively and eight or 13 per cent had the loss of one ankle jerk. This means that 45 per cent of the patients suffered permanent reflex changes as a result of operation. This can only be attributed to the effects of retraction of the nerve trunks and dura during the operative procedure.

TABLE VI
REFLEX CHANGES RESULTING FROM SURGICAL PROCEDURE

	No.	Per cent
Absent knee jerk prior to surgery	2	....
Return of reflex following surgery	2	100
Absence of one ankle jerk prior to surgery	58	....
Return of reflex following surgery	14	24
No return to reflex following surgery	44	76
No reflex changes prior to surgery	59	....
No change following surgery	32	54.2
Loss of both ankle jerks following surgery	19	32.2
Loss of one ankle jerk following surgery	8	13.6

There were also eight patients who had loss of an additional ankle jerk following operation whereas only one was absent preoperatively.

Other evidence that the surgical procedure itself can leave permanent changes is shown in Table VII. There was one case of loss of sphincter control and saddle anesthesia postoperatively with considerable but incomplete return at the time of examination. There were seven cases of slight weakness of dorsiflexion and three of slight weakness of plantar flexion. None of these patients was disabled and none required any treatment or support.

TABLE VII
NEUROLOGIC RESIDUAL FOLLOWING SURGERY IN 130 CASES

	No.	Per cent
Area of numbness and hypesthesia	58	44.6
Slight weakness of dorsiflexion	7	5.4
Slight weakness of plantar flexion	3	2.3
Weakness of sphincter control and saddle anesthesia	1	0.8

The presence of postoperative hypesthesia was the greatest residual effect in these patients. Many volunteered that they had learned to live with an area of numbness in a leg, foot or toes. Others had to be asked specifically or tested by pinpoint examination to ascertain the sensory change. None considered this an inconvenience or disabling in any way, but it occurred in fifty-eight or 45 per cent of patients and usually was more extensive or did not correspond to the preoperative area of hypesthesia. One must attribute this to nerve root irritation at the time of operation.

X-RAY STUDIES

X-ray examination of the lumbar spine was routine preoperatively in all patients. An absolute diagnosis of a herniated intervertebral disc cannot be made on x-ray evidence alone, but in a few instances x-ray evidence can strongly corroborate the clinical impression. In reviewing the preoperative x-rays of these patients the only significant findings were a straight lumbar spine in many cases, occasional list of the lumbar spine and narrowing of the intervertebral space. Of these, only the loss of lumbar lordosis appeared with any degree of regularity and of course was usually due to reflex spasm of the back muscles. This was also responsible for the list as evidenced in the x-ray of a very few cases. The list was not always away from the side of the lesion and there was a list toward the lesion with equal frequency.

Narrowing of the intervertebral space could only be relied upon if the fourth space was involved. The lumbosacral space is ordinarily narrower than the others in most individuals and there is a great deal of variation in the width of this space. In reviewing these cases we found several instances in which the lumbosacral space appeared very narrow by x-ray and yet the lesion upon myelograms or at surgery was found to be in the fourth space. This was present with sufficient regularity to almost rule out the width of the lumbosacral space as an indicative phenomenon.

TABLE VIII
POSTOPERATIVE X-RAY FINDINGS IN 130 CASES

	No.	Per cent
No demonstrative x-ray changes following surgery	34	26.2
Narrowing of intervertebral disc space		
*One plus	72	55.4
Two plus	20	15.4
Three plus	4	3.0
Total	96	73.8
Sclerosis or increased sclerosis of adjacent end plates	39	30.0

* See text for description of gradation

On the other hand, narrowing of the fourth space when present was almost 100 per cent indicative of a lesion at that space. Narrowing of this space is definitely significant when present whereas one must regard a narrow lumbosacral space with caution. However, in the final analysis it should be stated that in the vast majority of patients in this series the preoperative x-rays were entirely negative.

Postoperative x-ray examinations were made in all patients and have proved to be most interesting in their details. As illustrated in Table VIII only thirty-four of the 130 cases or 26.2 per cent failed to reveal any changes in follow-up x-rays. On the other hand, ninety-six or 73.8 per cent showed some narrowing of the disc space. This narrowing was graded as one, two or three plus, one plus being from minimal to one-third narrowing of the intervertebral space, two plus from one-third to two-thirds narrowing and any narrowing greater than two-thirds the width of the disc space, such as a complete collapse, was considered the maximum or three plus. The large majority was the minimal, but definite or one plus, narrowing. (Figs. 1 and 2.)

Of greater interest in correlation to the physical findings in these patients was the incidence of arthritic changes as evidenced by sclerosis or increased sclerosis of the vertebral end plates at the site of the lesion following operation. This occurred in thirty-nine cases or 30.0 per cent and despite such changes in the spine as evidenced by x-ray and well illustrated in the roentgenogram figures, these patients are asymptomatic and have no major back complaints. If this correlation can be applied to patients without disc lesions, it would be difficult to state that sclerosis and eburnations of the end plates of intervertebral joints is the cause of back pain.

One would expect a strain on the posterior articular facets with resultant arthritis and pain in those patients with severe postoperative narrowing and collapse and yet this was not found to be the situation in this series. Of the five patients who presented themselves at examination with some spasm and limitation of motion of the back, only one had severe arthritis upon x-ray examination. Much of this had also been present preoperatively. This patient had undergone two disc operations at the same site, had marked changes by x-ray and is the only patient that we consider may have possibly benefited from a spinal fusion. He was one of the patients who only claimed 50 per cent improvement postoperatively and had some spasm and limitation of motion postoperatively. However, he is working regularly as a foreman in a steel mill and getting along satisfactorily.

SUMMARY

An attempt has been made to demonstrate the end results in an unselected number of patients who had surgical treatment for herniated or ruptured intervertebral disc. One hundred thirty cases were studied.

The study revealed a ratio of male to female of almost two and one-half to one. The age incidence was about the same and averaged thirty-eight to thirty-nine years of age. There was an incidence of trauma in 48.5 per cent of patients.

The diagnosis followed a definite pattern in all patients. The signs and symptoms in physical examination were back and radiating leg

FIG. 1. A and B are x-rays of a thirty-nine year old male patient preoperatively. C and D are x-rays taken at follow-up examination six years and four months later. The patient is asymptomatic. This is considered a two plus narrowing.

pain with muscle spasm of the lumbar spine, limitation of motion of the back, limitation of straight leg raising and neurologic changes. Sensory changes in the form of paresthesias were present in most cases, but the reflex changes were the best guide to localization. There was an absence of reflex changes in 75 per cent of fourth space lesions whereas the ankle jerk was absent in 65 per cent of fifth space lesions. Lesions of the fourth and fifth spaces comprised 95.7 per cent of the total number of lesions proven by surgery.

Plain x-ray views of the lumbar spine were negative in the majority of patients, but a list of the lumbar spine and narrowing of the intervertebral space, especially the fourth space, were suggestive of disc lesions. The width of the lumbosacral space was not considered to be of diagnostic value. Myelograms were performed in fifty-nine cases and revealed this procedure to be about 90 per cent efficient. The spinal fluid total protein determination was performed in eighty patients and revealed an elevation in 69 per cent.

The surgical procedure consisted of a laminotomy or laminectomy with removal of as much of the degenerated nucleus pulposus as possible. There were ninety-three herniated discs, twenty-three ruptured discs and fourteen negative explorations. The incidence of double

FIG. 2. A and B, preoperative x-rays of a male patient, aged thirty-eight, at the time of surgery. C and D, films taken at follow-up examination three years later. Note the complete collapse of the lumbosacral space for a maximum or three plus narrowing. The patient is asymptomatic.

lesions was 2.6 per cent in proven cases. Twelve patients required a second operation, the highest incidence being recurrence of herniated or ruptured disc at the same space in six patients. There were two interesting complications of spinal fluid cyst which developed postoperatively.

The postoperative period in the follow-up of these patients averaged three years and three months. All patients except one had returned to productive work and 90 per cent had returned to the same kind of work performed prior to the onset of their disability. Of the 130 patients interviewed 87 per cent reported 100 per cent improvement and none reported no improvement following surgery. Examination of these patients revealed only five to have any limitation of back motion or spasm. There was an area of numbness and hypesthesia in about 45 per cent of the cases. The return of reflexes following surgery was the exception and there were definite reflex alterations due to the surgical procedure itself.

Follow-up x-ray examination of the lumbar spine in all patients revealed degrees of narrow-

ing in 73.8 per cent of patients and arthritic changes characterized by sclerosis in 30 per cent. However, there was no correlation between these x-ray results and the clinical results and even patients with severe collapse of the intervertebral space were asymptomatic. There was only one patient who may possibly have had a better result if a spinal fusion had been performed.

CONCLUSIONS

It must be concluded that the surgical treatment of a herniated or ruptured intervertebral disc consisting of simple excision of the nucleus pulposus is a satisfactory procedure in properly selected cases. Spinal fusion does not seem to be necessary to insure good results and the long period of disability and economic loss contraindicates this as a procedure of choice.

It is apparent that some patients show a certain amount of sensory and reflex changes and there is demonstrable narrowing of the intervertebral disc space as evidenced by the x-ray films. This variation in the disc space does not produce symptoms. It must be granted that the follow-up period may not be sufficiently long, the longest period postoperatively being ten years. However, these patients are all doing well and living happy and useful lives.

PATIENTS with pneumothorax in whom pleural effusion develops or who show insufficient collapse of cavities, a shift of the mediastinum or positive sputa in spite of apparently successful and repeated refills may be suffering from pleural adhesions. Such patients, W. E. Kunstler thinks, ought to be thoracoscoped. He considers this a minor procedure and states that often a skillful operator is able to divide these adhesions and thus greatly improve the patient's clinical condition. (*Richard A. Leonardo, M.D.*)

AN EVALUATION OF EXTRAPLEURAL PNEUMONOLYSIS WITH LUCITE PLOMBAGE

A PRELIMINARY REPORT

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THE purpose of this paper is to analyze the results obtained in sixty-three consecutive operations using extrapleural pneumonolysis with lucite plombage in the treatment of pulmonary tuberculosis at the Missouri State Sanatorium at Mount Vernon, Missouri, from February 2, 1947, until September 21, 1949. The sixty-three operations were performed upon fifty-nine patients, twenty-eight females and thirty-one males. The average age was thirty-five years the youngest being fifteen and the oldest sixty. There were fifty-seven white and two colored patients in this series. All patients except nine were given epidural anesthesia. Twenty-five patients had surgery upon the right side and thirty patients had surgery upon the left side.

Tuffier first performed the pleuroparietal stripping operation in 1891. A multitude of substances has been used to maintain pulmonary collapse since the first operation was performed. These substances include muscle, fat, air, paraffin, oil, gauze, cellophane, rubber, fiber glass and more recently lucite (methyl methacrylate) in the form of spheres. This substance was introduced by Wilson and Baker in 1945.

Our study was undertaken to evaluate the results obtained at the Missouri State Sanatorium, Mount Vernon, Missouri and to determine the advisability of continuing this procedure due to the recent unfavorable reports dealing with this operation.

By initially selecting some cases to have extrapleural pneumonolysis with plombage instead of thoracoplasty or some other collapse procedure we did not intend to put this operation upon a competitive basis with the other procedures but rather as another valuable supplemental therapy in the thoracic surgeon's armamentarium. We recognize that thoracoplasty until the present time has been one of the most reliable types of collapse therapy.

There are definite primary and secondary indications for performing this type of operation as well as definite primary and secondary contraindications.

The primary indications or advantages of extrapleural pneumonolysis are moderately and far advanced unilateral or bilateral apical or subapical lesions with small and medium-sized cavities (not more than 4 cm. in diameter), selective collapse, low respiratory reserve and cardiac insufficiency.

The secondary indications or advantages of this procedure are as follows: It is a one-stage procedure; there is no possibility of paradoxic respiration; it is a simple technical procedure and can be a reversible one; it is the operation of choice in adolescents or growing patients before they attain adult stature; the operation is popular with patients; and it provides a cosmetic effect.

The primary contraindications to this procedure with plombage are large or giant cavities that are subpleural in position and have thin walls that are surrounded by soft exudative disease, tuberculous bronchiectasis, free pleural space and thick-walled cavities or tuberculomas.

The secondary contraindications or disadvantages are foreign body, obscures accurate postoperative x-ray determinations and thick parietal and visceral pleura.

Primary Indications. In order that we could compare extrapleural pneumonolysis using lucite with thoracoplasty we performed this operation in several cases of moderately to far advanced pulmonary tuberculosis. We selected cases with unilateral or bilateral apical or subapical lesions with small or medium-sized cavities. When dealing with unilateral lesions the usual indication would be a thoracoplasty.

However, we desired to investigate whether this simpler technical procedure was as adequate as thoracoplasty. In the treatment of bilateral disease it is of great importance to preserve as much breathing capacity as possible. For this reason plombage seemed a desirable choice in either one or both sides. Extrapleural pneumonolysis with lucite plombage offers a more selective type of collapse than any other type of collapse therapy. A large percentage of patients with active moderately to far advanced pulmonary tuberculosis have a low respiratory reserve. Among numerous examples are the elderly patients with emphysema, patients with previous thoracoplasties, pneumothoraces, resections and with spreads or reactivations to the contralateral side where a pneumothorax is not feasible. A large per cent of patients with active to far advanced pulmonary tuberculosis have a low cardiac reserve.

Secondary Indications. The required amount of pulmonary collapse can usually be carried out with a one-stage operation. There is no possibility of postoperative paradoxic respiration as may occur following thoracoplasty. It is a simple technical procedure as compared to a resection or a thoracoplasty. It may be a reversible collapse procedure in that lucite spheres may be subtracted, or even more important, additional spheres may be added if the required collapse is not obtained in the initial operation. It is the operation of choice in adolescents or growing patients before they attain adult stature. This operation has often been acceptable to patients who have refused any other major procedure. The lack of resultant deformity with this procedure is a desirable feature, especially in the young female.

Primary Contraindications. Plombage is contraindicated in collapsing cavities larger than 4 cm. in diameter. This is especially true if the cavity is adjacent to the visceral pleura, or if it is a so-called tension cavity. In these cases there is great danger of tearing into the cavity during the operation or pressure from the plombage may cause necrosis of the cavity wall with resulting bronchial fistula and empyema. In our opinion any type of collapse therapy is debatable if tuberculous bronchiectasis exists, either with or without cavitation. It is possible to close and heal the cavity without improving the bronchiectatic disease which may still be the source of a positive sputum. A free pleural space is a definite contraindication to using plombage because there is great danger of tearing the pleura during the procedure. Even if this tear is carefully repaired during surgery, there is danger of the spheres migrating from the extrapleural to the pleural space with subsequent complications. In our opinion very thick-walled cavities, so-called inspissated cavities and tuberculomas, are not affected by any form of collapse therapy and should receive resection in the majority of cases.

Secondary Contraindications. Any foreign body may not be tolerated well by some patients. However, lucite causes less tissue reaction than most plombage materials. The accuracy of postoperative x-ray cavity detection may be obscured because of lucite spheres.

TECHNIC

All patients received streptomycin and penicillin preoperatively. The lateral position on the table and the posterior approach was used in all cases. Fifty-four operations were done under epidural anesthesia and nine received nitrous oxide.

The technic of epidural anesthesia will be reviewed briefly as we believe that it has played a very important role in preventing postoperative spreads and reactivations. There were no postoperative spreads or reactivations in the sixty-three cases.

All patients were given the usual barbiturate sedation the night before surgery and two hours before surgery. The foot of the bed was elevated five hours before surgery so that the tracheobronchial tree would be as free as possible of bronchial secretions. No morphine or atropine is given preoperatively.

All patients were skin tested the day before surgery with novocain and pontocaine to determine sensitivity. A positive pontocaine reaction would contraindicate its use and a positive novocain reaction would contraindicate epidural anesthesia.

The novocain-pontocaine mixture is dissolved in 28 cc. of normal saline solution. Five hundred to 600 mg. of novocain and 20 to 40 mg. of pontocaine are used, depending upon the length of the surgery anticipated. To this mixture is added 0.5 cc. of 1 to 1,000 adrenalin.

The patient is placed in the sitting position on the operating table with the upper back kyphosed and the neck flexed. An assistant supports the patient's head. This position greatly facilitates finding the spinous processes,

especially in the more obese patients. The skin is cleaned with an antiseptic of choice, and the site of puncture is selected between the spinous processes of the seventh cervical to the third thoracic vertebrae. The higher interspaces are preferred because the greatest anesthesia should be in the apical and subapical regions.

A small skin wheal is made with 1 per cent novocain in the exact midline in the interspace selected. A 25 gauge needle is used for this step and also to inject the subcutaneous tissue. The opening in the skin made by the 25 gauge needle is enlarged with a regular 18 gauge needle. A short beveled 18 gauge spinal needle is then inserted with the stylet *in situ*. The various structures penetrated are recognized by their differences in resistance. There is moderate resistance at the supraspinous ligament, slight at the interspinous ligament and a marked resistance at the tough ligamentum flavum. When the needle has been advanced to the ligamentum flavum, the stylet is removed and a drop of normal saline is placed in the hub of the needle. The point of the needle is advanced very carefully through the ligamentum flavum so that the dura mater is not penetrated. This step is accompanied with a definite drop which sometimes is almost a snap and indicates that the needle point is in the epidural space. The saline in the hub of the needle will be sucked in due to the negative pressure within this space. Several cubic centimeters of normal saline are injected to clear the needle of any tissue and to push the dura away from the needle point so that there is no danger of getting into the subarachnoid space. If the saline goes in easily, an attempt to aspirate blood or spinal fluid is made. If this test is positive the needle is immediately withdrawn and a higher or lower interspace is selected. If the test is negative, another drop of saline is placed within the hub of the needle, and the "drop sign" is usually then observed due to the negative pressure within the epidural space.

These tests indicate proper localization within the epidural space so the first 10 cc. of the anesthetic solution is given. The patient will usually complain of quite severe pain in the neck, arms, back and shoulders after the first 5 cc. are given. This pain is due to pressure on the nerve roots and is a valuable sign that the anesthetic solution is being given in the proper space. Ephedrine sulfate $\frac{3}{8}$ to $\frac{3}{4}$ gr. is given subcutaneously after the first 10 cc. have been injected to maintain a steady blood pressure throughout the operation. The remaining 20 cc. are given after a slight pause after each 10 cc. to allow for proper dissipation of the solution. The total amount of anesthetic solution given is 30 cc. The patient is then placed with his operative side down for ten minutes in order to take further advantage of the gravitation of the fluid.

We have preferred the posterior approach in all cases. A curved incision of 6 to 8 inches in length is made halfway between the lateral margin of the scapula and the spinous processes of the upper thoracic vertebrae. A small segment of the third or fourth rib is usually resected subperiosteally and the scapula is retracted laterally and upward. The extrapleural space is located and the parietal pleura is then gently separated from the endothoracic fascia. Great care is taken to maintain hemostasis at all times. The dissection is usually started anteriorally and continued laterally and posteriorally until the apex and subapical region is freed. The parietal pleura is usually separated from the mediastinal structures with great care. We have always freed the parietal pleura to at least the level of the second rib anteriorally so that aspiration could be done if necessary.

The entire apex should be freed with care being taken to free the mediastinal aspect so that a true apicolysis is done. No lung tissue is left suspended to the apex. After the extrapleural space is created, the lucite spheres are inserted and the wound is closed in layers. The average number of spheres that were used was thirty-five.

The postoperative care of these cases is relatively simple. Penicillin and streptomycin are continued for at least two weeks following surgery and are extended if the clinical picture or fluoroscopic examination indicates the need. Oxygen inhalation is administered for one or two hours after the patient returns to the ward from the operating room. Morphine sulfate $\frac{1}{8}$ to $\frac{1}{6}$ gr. or demerol 50 to 75 mg. is given every three to four hours, if needed.

The patients are fluoroscoped the day after the operation and it is repeated daily throughout the first week. This is done to detect extrapleural effusions and to check the position of the lucite pack. If, however, severe pain is present, or an amount greater than 100 to 150 cc. of extrapleural fluid or blood is esti-

mated, the patient should be aspirated. This procedure not only relieves pressure but also keeps the amount of pulmonary collapse within desired limits. Aspirations are usually carried out in the first or second intercostal space in the mid-clavicular line. When large extrapleural effusions are present and aspiration is impossible due to clotting, the extrapleural space is reopened and the clots removed.

COMMENTS

Sixty-three plombage operations were performed upon fifty-nine patients. Forty-four of these cases were classified as far advanced pulmonary tuberculosis and fifteen as moderately advanced. Forty-seven cases had bilateral disease and only twelve had what we classified as unilateral disease at the time of their operation. All patients had a positive sputum preoperatively.

Primary Indications. There were twenty-four cases in which we thought that lucite pack was the treatment of choice. All of these cases had bilateral disease with the contralateral side controlled by pneumothorax (twelve cases) or thoracoplasty (twelve cases) and with active disease in the operative side. All of these patients had a positive sputum immediately before surgery. Twenty of the twenty-four became sputum-negative after surgery. Thus the incidence of conversions was 83.3 per cent.

A negative sputum means that the patient had six negative sputum smears, six negative sputum concentrates and a gastric lavage with negative culture and negative guinea pig inoculation.

Thus we believe that lucite pack is justified treatment in bilateral pulmonary tuberculosis with active disease in one side and controlled disease in the contralateral side. The respiratory reserve in these cases was so inadequate that any other form of surgical treatment seemed contraindicated. There were thirty-one cases in which thoracoplasty might have been the operation of choice instead of lucite pack. Nineteen of these cases had bilateral disease and twelve had unilateral disease.

Six of these cases have not yet had their sputum analyzed postoperatively as they have been operated upon less than two months. Thus there were twenty-five cases for sputum analysis. In this group sixteen became sputum-negative. This is an incidence of 66.7 per cent, almost as good as is obtained with thoracoplasty. There were four cases which had lucite packs bilaterally. Two of these cases were converted.

Secondary Indications. The secondary advantages of extrapleural pneumonolysis are self-explanatory, and a discussion of these would prolong this paper unnecessarily.

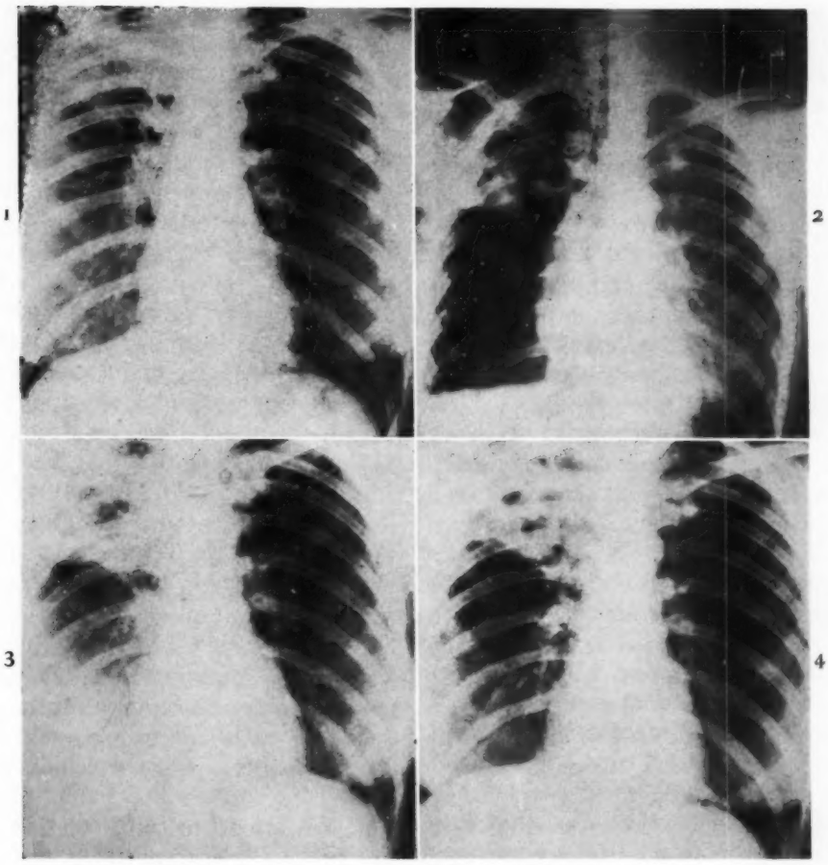
Primary Contraindications. In our sixty-three cases there were three cases of residual cavitation beneath the lucite pack. These residual cavitation cases all had cavities larger than 4 cm. in diameter. They are still positive. We did not break into the cavity in any of the cases during surgery. However, bronchial fistula developed in three cases. Two of these cases had giant cavities and a necrosis of the wall probably followed the operation due to pressure of the lucite spheres. Besides cavitation seven of our non-converted sputum cases had bronchietasis throughout the area of the lung in which collapse was desired. The bronchiectasis were visualized by bronchograms pre- and postoperatively. Laminographs did not show residual cavitation under the lucite spheres. In our opinion the sources of the positive sputum is from the bronchiectasis which we believe is tuberculous in nature. A free pleural space is a definite contraindication to using plombage because there is great danger of a pleural tear during the procedure. One patient is reported fully in our illustrative case. Cases with tuberculosis and thick-walled cavities should have resections instead of plombage in the great majority of cases.

Secondary Contraindications. We have had no severe reactions towards lucite. However, some untoward reactions have been reported in the literature.

COMPLICATIONS

The following complications occurred in our series of sixty-three cases: bronchial fistula, three; major extrapleural hemorrhage, five; pleural tear, one; migration of spheres into subcutaneous tissue, one; residual cavitation, three and cardiorespiratory failure, one.

In all cases in which bronchial fistula developed the lucite spheres were removed. One patient died nine months postoperatively from the bronchial fistula and empyema. Another case has spontaneously closed the small bronchial fistula but still has slight drainage from an extrapleural sinus. The third case had a



multiple stage thoracoplasty and operative closure of the bronchial fistula.

Four of the five cases in which extrapleural hemorrhage developed responded to aspiration. The fifth patient died following an unsuccessful operative effort to remove an extrapleural blood clot which could not be aspirated. This surgery was done one month after the insertion of the lucite spheres. The lung had been excessively compressed and would not respond to inflation so a pneumonectomy was done. The patient died twenty hours following the pneumonectomy from cardiorespiratory failure. The low cardiorespiratory reserve was the influencing factor for plombage versus pneumonectomy.

The only case of pleural tear which might have been followed by severe complications is reported herein. (Figs. 1 to 3.)

S. A. L., a thirty-eight year old white woman, was admitted to the Missouri State Sanatorium August 3, 1948, with a history of cough and expectoration of three months' duration. The sputum was positive for tubercle bacilli on direct smear. A bronchoscopic examination revealed nothing abnormal. The patient was diagnosed as having moderately advanced pulmonary tuberculosis of the right lung. (Fig. 1.) The left lung was clear. The patient was treated with bed rest for two months. During this period she had a six weeks' course of streptomycin (1 gm. daily for forty-two days) and the x-ray showed slight improvement.

On October 5, 1948, a right pneumothorax was started. On November 8th a closed intrapleural pneumonolysis was attempted but the operation was abandoned due to the finding of several pinhead-sized tubercles on the visceral pleura. Pneumothorax was discontinued and the patient was advised to have extrapleural pneumonolysis with lucite plombage at a later date when symphysis between the visceral and parietal pleura was expected to have taken place.

An extrapleural lucite plombage on the right side was performed on February 16, 1949, under epidural anesthesia.

During the operation a 1-inch tear was accidentally made in the parietal pleura and a pneumothorax resulted. The tear was carefully repaired with interrupted nylon sutures and

the pleural air was aspirated before fifteen marbles were placed in the extrapleural space. The day after operation the patient complained of shortness of breath. During routine fluoroscopic examination a right hydropneumothorax was detected underneath the marble pack. X-ray confirmed the fluoroscopic finding. (Fig. 2.) Approximately 900 cc. of air and 125 cc. of blood were aspirated. X-ray made three days postoperatively showed that the lung had reexpanded except at the base where a small amount of fluid was still present. The spheres had all remained in the extrapleural space. (Fig. 3.)

The patient made an uneventful recovery and has had a negative sputum since operation. She is now on exercise and will soon be ready for discharge. Her latest x-ray is shown in Figure 4.

Also in our series there was one case in which the spheres migrated subcutaneously. This case is one of the three cases included among the bronchial fistulas. There were three cases of residual cavitation. All of these cases still have a positive sputum. One case has refused further surgery. The second case is scheduled for additional spheres. The third patient has such a low cardiorespiratory reserve that further surgery seems contraindicated. There was one cardiorespiratory death which occurred four days following surgery. This patient was a salvage case. There were no cases showing postoperative spreads or tuberculous infection among the spheres.

MORTALITY

There were four deaths in our series of sixty-three patients. Thus the over-all mortality was 6.3 per cent. The first patient died nineteen months following the extrapleural pneumonolysis with lucite spheres. The cause of her death was unknown. The patient had been discharged seven months prior to death as an arrested case. The second case died nine months after surgery from a bronchopleural fistula and tuberculous empyema. The third case died one month postoperatively following the insertion of the lucite pack. This is the patient in whom an extrapleural clot developed which could not be aspirated so a pneumonectomy was done after an unsuccessful attempt to inflate the lung following the removal of the clot. The patient died within twenty-four hours after the pneumonectomy from cardiorespiratory insufficiency. The fourth patient died four days after surgery from cardiorespiratory insufficiency. This patient was a salvage case. The corrected mortality is two deaths in sixty-three cases, i.e., 3.1 per cent.

SUMMARY AND CONCLUSIONS

1. Sixty-three operations using extrapleural pneumonolysis with lucite spheres are analyzed.

2. The early results obtained are encouraging; we will continue a careful scrutiny of these cases.

3. We intend to continue this procedure for the present with cases that have fulfilled the indications that we have outlined.

REFERENCES

1. Wilson, D. A. and Baker, H. *Surg., Gynec. & Obst.*, 82: 735, 1946.
2. Wilson, D. A. Extrapleural pneumonolysis with lucite plombage. *J. Thoracic Surg.*, 17: 111, 1948.
3. Walkup, H. E. and Murphy, J. D. Diseases of chest. 16: 18, 1949.
4. Trent, J. C., Moody, J. D., Hiatt, J. S. and McCain. *J. Thoracic Surg.*, 18: 173, 1949.

BRACHIAL PLEXUS ANESTHESIA

COMPARATIVE STUDY OF AGENTS AND TECHNICS

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IN a series of 390 brachial plexus blocks performed for surgical anesthesia various agents and technics were used in an attempt to evaluate their effectiveness and the duration of anesthesia obtained. Observations of this nature have not been completely presented previously. The blocks included in this report were performed by the authors from November, 1945, to May, 1949. Ninety-one per cent of the patients were young adult males between the ages of nineteen and forty-eight years of grade one physical status[1] in the military service. The remainder were patients in a municipal general hospital. Almost all the operations performed were elective in nature and consisted of orthopedic and plastic reconstructions of the hand and forearm. The others were sequestrectomies, bone grafts, incisions for drainage or repair of fresh lacerations.

The agents used were as follows: (1) 2 per cent procaine in saline plus epinephrine in a final concentration of from 1:300,000 to 1:200,000; (2) 2 per cent procaine plus 0.1 per cent pontocaine hydrochloride in saline plus epinephrine 1:200,000; (3) 1½ per cent monocaine formate in saline plus epinephrine 1:300,000; (4) 2 per cent procaine hydrochloride in normal saline solution.

In all patients an attempt was made to anesthetize the brachial plexus where it crossed the first rib. The methods used included: (1) Supraclavicular approach in which contact with the brachial plexus as manifested by paresthesias was sought; (2) supraclavicular approach after Patrick's[2] technic in which a "wall of anesthesia" was infiltrated along the first rib without intentionally seeking to obtain paresthesias. If paresthesias were elicited, 10 cc. of the solution were injected at that point in addition to the infiltration; (3) continuous brachial plexus anesthesia.

Results were evaluated according to the following criteria: *Excellent:* No other anesthesia or method was necessary and there were no complaints of pain or discomfort. *Satisfactory:* The block was effective for more than one hour but other anesthesia was necessary either because the operation outlasted the block or in order to allow operating on another area of the body, i.e., donor sites for skin, tendon or bone grafts. *Unsatisfactory:* Anesthesia was either insufficient to permit operation or the patient experienced pain at the operative area or site of the tourniquet within one hour of the original block.

Anesthesia time was measured from the completion of the blocking procedure. The termination of block anesthesia could be determined in those cases in which a long operation outlasted the block anesthesia. Otherwise the duration of anesthesia was recorded up to the completion of the operation. From these two sets of figures the expected duration of anesthesia could be approximated.

Results with Procaine plus Epinephrine. One hundred ninety-three brachial plexus blocks were performed with a solution of 2 per cent procaine containing epinephrine (1:300,000 to 1:200,000) in quantities ranging from 30 cc. to 50 cc. Most of these procedures were completed without seeking paresthesias. Of these blocks 122 were excellent, thirty-one satisfactory and forty unsatisfactory.

The duration of anesthesia as recorded in 153 successful blocks is shown in Table 1. It will be seen that in thirty-one patients block anesthesia wore off before the completion of the operation. During fifty-nine operations lasting from sixty-one to ninety minutes, nine blocks (15 per cent) wore off. In forty-eight operations lasting from 91 to 120 minutes twenty-one blocks (45 per cent) wore off. During ten operations lasting from 121 to 150 minutes no blocks terminated.

We can expect anesthesia to last somewhat longer than ninety minutes when an effective blockade of the brachial plexus is accomplished with this procaine epinephrine solution.

Results with Procaine and Pontocaine plus Epinephrine. Brachial plexus blocks were administered to 156 patients using from 30 cc. to 50 cc. of a solution containing 2 per cent procaine, 0.1 per cent pontocaine and epinephrine (1:200,000). Paresthesias were sought in all patients in this series. Of these 112 were considered excellent, twenty-three satisfactory and twenty-one unsatisfactory. Many of the procedures listed as unsatisfactory were supplemented only by local infiltration at the wrist. In one such case 20 cc. of 2 per cent procaine were added locally a short while after the beginning of the operation. Anesthesia was then adequate for the total procedure which lasted six hours.

TABLE I
DURATION OF ANESTHESIA WITH PROCAINE PLUS EPINEPHRINE

Duration of Anesthesia in Minutes*	to 60	61 to 90	91 to 120	121 to 150	151 to 180	Total
Excellent (did not wear off during operation)	34	50	27	10	1	122
Satisfactory (did wear off during operation)	0	9	21	0	1	31
Total	34	59	48	10	2	153

* The duration of anesthesia for excellent blocks is given from the completion of the blocking procedure to the termination of the operation.

TABLE II
DURATION OF ANESTHESIA WITH PROCAINE AND PONTOCAINE PLUS EPINEPHRINE

Duration of Anesthesia in Minutes	61 to 90	91 to 120	121 to 150	151 to 180	181 to 210	over 211	Total
Excellent (did not wear off during operation)	32	28	21	6	4	2	93
Satisfactory (did wear off during operation)	0	3	2	3	1	2	11
Total	32	31	23	9	5	4	104

The durations of the successful blocks are recorded in Table II. It is evident that no block terminated in less than ninety minutes. In fifty-four operations lasting from 91 to 150 minutes only five blocks (9 per cent) ended before the operative procedure was completed. Four blocks (29 per cent) terminated during fourteen operations lasting from 151 to 210 minutes. In four cases lasting over 210 minutes two blocks wore off.

TABLE III
DURATION OF ANESTHESIA WITH MONOCAINE PLUS EPINEPHRINE

Duration of Anesthesia in Minutes	61 to 90	91 to 120	121 to 150	151 to 180	Total
Excellent (did not wear off during operation)	2	0	2	3	7
Satisfactory (did wear off during operation)	1*	1	0	0	2
Total	3	1	2	3	9

* Without epinephrine.

With the solution and technic used one can expect that at least two and one-half hours of anesthesia will be obtained with successful blocks.

Results with Monocaine. In an attempt to find a long-acting anesthetic agent that would have a toxicity no greater than that of procaine, monocaine formate* was tried. It has been shown[3] that 1½ per cent solutions of monocaine are approximately equal in toxicity to 2 per cent solutions of procaine and provide longer lasting anesthesia. Large volumes of 1 per cent and 1½ per cent monocaine solutions have been used by Rovenstine and Apgar[4] in caudal anesthesia without toxic reactions.

The results of nine brachial plexus blocks performed with 1½ per cent monocaine formate are shown in Table III. The first block was performed without a vasoconstrictor and the anesthesia which was complete lasted only sixty-five minutes. In the other eight cases epinephrine (1:300,000) was added to the anesthetic solution; seven were excellent lasting from 75 to 180 minutes and one was satisfactory wearing off in eighty minutes.

* Monocaine formate crystals were supplied through the courtesy of the Novocol Chemical Manufacturing Company. The 1½ per cent solution was prepared in distilled water containing 0.5 per cent sodium bisulphite and 0.1 per cent chlorobutanol. It was sterilized by steam at 15 pounds pressure for fifteen minutes.

Anesthesia lasting over two hours can be expected from successful blocks with this monocaine and epinephrine solution. The efficacy of this drug is not apparent from the figures on duration of anesthesia. The onset of anesthesia was more rapid and the anesthesia more complete even to the extent of complete abolition of motor function. It is recognized and emphasized that these few cases are insufficient basis for definite conclusions. They are reported merely to stimulate interest and suggest further investigation.

Results with Procaine. A solution of 2 per cent procaine without an added vasoconstrictor was used in performing twenty-three brachial plexus blocks. Of these eighteen were excellent and five unsatisfactory. This solution was used for operations expected to be of short duration only. As a result none of these blocks wore off before the completion of the operation. It is impossible to estimate expected duration of anesthesia with 2 per cent procaine from these figures.

Results with Continuous Brachial Plexus Anesthesia. In an attempt to extend the use of brachial plexus anesthesia to longer operations Ansbro[5,6] devised a method of continuous brachial plexus block using a malleable needle left in position. Forty to 100 cc. of 1 per cent procaine without epinephrine were injected by means of a continuous setup. In this way a "flooding action" was used. A somewhat similar technic was attempted independently by one of us (W. M. S.) using a 4F. ureteral catheter. Plexus block was first performed according to orthodox technics. Then a fifteen-gauge needle was inserted so that its tip lay in the vicinity of the brachial plexus. The catheter was threaded through and the needle withdrawn. At one-hour intervals 30 cc. of 2 per cent procaine without epinephrine were administered through the catheter. In all nine patients the original block was effective. In five patients the first additional dose was not effective. However, in the other four anesthesia was excellent, two patients being anesthetized 2½ hours and two, three hours. The method was not pursued further although if larger volumes are used after the technic of Ansbro, better results are more likely.

Significance of Parestbesias. Among 192 blocks in which paresthesias were intentionally sought 13 per cent showed unsatisfactory results. In 198 procedures in which paresthesias were not sought though frequently elicited 20 per cent were unsatisfactory blocks. The incidence of paresthesias was recorded in 120 cases in this latter group. These results are presented in Table IV. When paresthesias were elicited, effective anesthesia was obtained in 85 per cent. When no paresthesias or questionable paresthesias were evoked, the blocks were effective in only 67 per cent. It is apparent that anesthesia is more likely to be effective when paresthesias are elicited during the blocking procedure.

TABLE IV
RESULTS OF BRACHIAL PLEXUS BLOCKS ACCORDING TO PARESTHESIAS ELICITED IN 120 CASES

Paresthesias Elicited	No. of Cases	Percentage		
		Excellent	Satisfactory	Unsatisfactory
1. Ulnar	18	61	17	22
2. Radial	19	63	21	19
3. Median	10	30	60	10
4. Two or more	25	68	20	12
5. Total of 1, 2, 3, 4	72	60	25	15
6. Questionable	12	58	17	25
7. No paresthesias	36	42	22	36
8. Total of 6, 7	48	46	21	33
9. Total of all	120	54	26	20

Complications. In this series of 390 brachial plexus blocks there were no cases of clinically recognizable pneumothorax, emphysema, nerve damage, disorientation, convulsions or other major complication. Puncture of the subclavian artery by the exploring needle occurred in an estimated 30 per cent of patients. This was asymptomatic and harmless. Three patients showed supraclavicular tenderness without redness, swelling or ecchymosis for two or three days. This was thought to be due to small hematomas or trauma by the needle.

Toxicity of Pontocaine. Until recently there had been a hesitancy to use pontocaine in the large doses required in regional anesthesia because of its relatively high toxicity.[7,8] However, in a series of 500 obstetric patients receiving 30 to 40 mg. of pontocaine into the caudal

canal as an initial injection during continuous analgesia a lack of serious systemic toxicity was reported.[9] Moore[10] has recently reported a large series of cases in which pontocaine was injected into the patients with only one severe reaction in 1,004 procedures.

In the present series of 156 blocks and in an additional 365 cases observed by one of us (B. R.) in which 30 to 50 mg. of pontocaine were injected into the supraclavicular area of the patients along with approximately 800 mg. of procaine and 0.3 mg. of epinephrine we were impressed by the absence of toxic signs sufficient to warrant treatment. In some patients palpitation and apprehension were noted; nausea and vomiting were seen twice and there were no complaints of neurologic sequelae. In proper evaluation of these experiences it must be reiterated that 91 per cent of these patients were healthy young males.

SUMMARY AND CONCLUSIONS

1. Results of 390 brachial plexus blocks are reported with special reference to comparisons of agents and technics used. Of these blocks 68 per cent were excellent, 15 per cent satisfactory and 17 per cent unsatisfactory.

2. Expected duration of brachial plexus anesthesia with a procaine and epinephrine solution is approximately ninety minutes.

3. Addition of pontocaine to this solution of procaine and epinephrine increases the expected duration of anesthesia to 150 minutes.

4. A solution of monocaine formate and epinephrine provides rapid, complete brachial plexus anesthesia lasting beyond 120 minutes.

5. Continuous brachial plexus anesthesia requires large volumes of solution for excellent results.

6. Eliciting paresthesias during brachial plexus blocks increases the percentage of successful procedures.

7. Injection of large doses of pontocaine hydrochloride into the region of the brachial plexus is not attended by serious toxic effects.

REFERENCES

1. Saklad, M. Grading patients for surgery. *Mod. Hosp.*, *55*: 59, 1940.
2. Patrick, J. The technique of brachial plexus block anesthesia. *Brit. J. Surg.*, 27: 734–739, 1940.
3. Epstein, E. and Silver, D. Comparative toxicity and potency of commercial monocaine and procaine solutions. *Anesth. & Analg.*, 24: 38–42, 1945.
4. Rovenstine, E. A. and Apgar, V. Spinal anesthesia with monocaine formate: results in 2,230 cases. *Anesthesiology*, 5: 40–44, 1944.
5. Ansbro, F. P. A method of continuous brachial plexus block. *Am. J. Surg.*, 7: 716–722, 1946.
6. Ansbro, F. P. Personal communication.
7. Phillips, F. J., Congleton, V. L. and Tuttle, W. Pontocaine hydrochloride reaction relieved by dial. *Anesth. & Analg.*, 20: 233–234, 1941.
8. Hansen, F. M., Jr. and Stealy, C. L. Sudden death following the use of pontocaine as a gargle anesthetic for gastroscopic examination. *Rev. Gastroenterol.*, 10: 212–213, 1943.
9. Brown, H. O., Thomson, J. M. and Fitzgerald, J. E. An analysis of 500 obstetrical cases with continuous caudal anesthesia using pontocaine. *Anesthesiology*, 7: 355–374, 1946.
10. Moore, D. C. The use of pontocaine hydrochloride for nerve block and infiltration analgesia, therapeutic and diagnostic blocks: 1004 cases. *Anesthesiology*, 11: 65–75, 1950.

SCALENUS ANTICUS SYNDROME*

UNUSUAL DIAGNOSTIC AND THERAPEUTIC ASPECTS

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SINCE Adson and Coffey[1] first demonstrated that the scalenus anticus muscle was involved in the production of neuritic and vascular disturbances of the upper extremity when a cervical rib was present, there have been many reports of such cases in the medical literature. Ochsner, Gage and deBakey[2] further reported several patients with this neurovascular syndrome in the absence of cervical ribs. There has been a diversity of opinion as to how the scalenus anticus muscle plays its pathogenic role in the development of such symptoms. The most comprehensive study of the relationship of the scalenus anticus muscle to the production of pain in this syndrome was carried out by Swank and Simeone.[3]

The purpose of this paper is to report forty-two patients seen in the last three years on whom a diagnosis of scalenus anticus syndrome has been made and especially to record many of the unusual and difficult diagnostic and therapeutic problems that have been encountered. This disorder is not uncommon, yet most of the patients have had diagnoses of myalgia, myositis, fibrositis, neuritis and cervical arthritis made before the correct diagnosis is considered.

Forty-two patients presenting forty-five scalenus anticus syndromes have been seen by the authors. Three patients had both upper extremities involved. Twenty-eight patients were subjected to scalenotomy or some procedure such as excision of a cervical rib or anterior thoracic sympathectomy in addition to the scalenotomy. Two of the patients operated upon were re-explored because of recurrence of pain. Five patients have been advised to have a scalenotomy, and nine have responded satisfactorily to conservative therapy. (Table I.)

Table II indicates that this group of patients presented the characteristic findings reported by others. It is well known that the majority of patients presenting symptoms and signs of this disorder are female and that the syndrome more commonly occurs on the left side. The average duration of symptoms prior to the establishment of a diagnosis was 23.6 months although the range was from three days to eighteen years. Cervical ribs or transverse processes of the seventh cervical vertebra sufficiently elongated to be considered as contributing to the pathogenesis of pressure on the brachial plexus were found in nine of the forty-two patients. Neurologic signs or symptoms were found in all the patients, and in

TABLE I
RESULTS OF TREATMENT

Treatment	
Conservative	9
Scalenotomy	28
Advised to have scalenotomy	5
Results of Scalenotomy	
Complete relief of symptoms	22
Satisfactory relief of symptoms	4
Poor relief or recurrence of symptoms	2

TABLE II
ANALYSIS OF SYMPTOMS AND SIGNS

No. of patients	42
No. of syndromes	45
No. of patients operated upon	28
Average age	40.4 yr.
Range of ages	23–62 yr.
Average duration of symptoms	23.6 mo.
Side involved	
Right	17
Left	22
Bilateral	3
Patients with cervical ribs or elongated transverse process (C_7)	9
Tenderness of scalenus anticus	44
Not recorded	1
Neurologic symptoms and signs	
Pain	45
Paresthesias	34
Motor weakness	17
Atrophy	7
Vascular signs and symptoms	20
Adson maneuver positive	27

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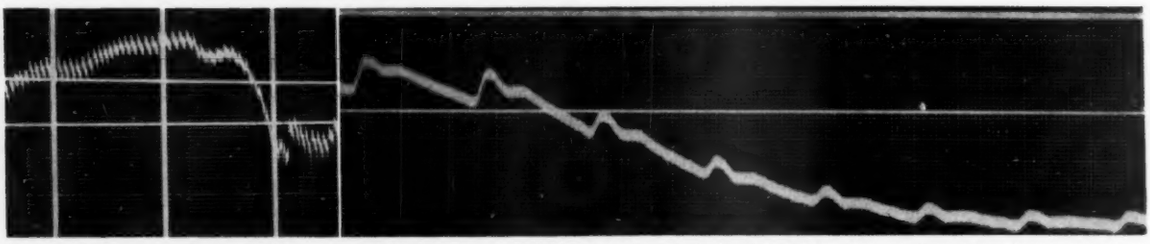

FIG. 1. Fast and slow plethysmographic tracings recorded from the left third finger on a Burch-Winsor plethysmograph; both records demonstrate the marked reduction in not only pulse amplitude but also the total volume of the part when the patient voluntarily holds his breath. This is the usual occurrence in normal individuals. The cessation of respiration should accordingly not be advised while the scalenus anticus muscle is being placed under tension.

twenty vascular as well as neurologic changes were observed. Tenderness on palpation of the belly of the scalenus anticus muscle was present forty-one times and was not recorded on one occasion. Extending the neck and rotating the head to the affected side reproduced or accentuated the pain in the extremity in twenty-seven instances. Reduction or obliteration of the oscillometric index was also observed when this maneuver was positive. This occurred on ten occasions when no vascular signs or symptoms were present; and since it is not uncommon in normal individuals, no great significance can be attached to it unless signs of arterial insufficiency are encountered, and the contralateral maneuver produces no change in the uninvolved extremity. The patient must also be cautioned not to hold his breath for this in itself will interfere with the peripheral circulation. (Fig. 1.)

From the observations made on this series of patients the scalenus anticus syndrome may be divided into an acute and chronic stage. The principal difference between the two is the almost constant presence of a history of acute trauma, the severity and diffuseness of the pain, the presence of muscle spasm and the relatively prompt response to conservative therapy in the acute stage. The chronic stage need not necessarily be associated with trauma although it frequently is; localized paresthesias and atrophy are more common and complete relief of symptoms is obtained in most instances only after a scalene tenotomy. There may be exceptions to the preceding statements. For instance, the untreated acute scalenus anticus syndrome following trauma may progress into a chronic stage as it did in eight of the patients operated upon. The type of acute trauma that may precipitate this syndrome varies tremendously and need not necessarily be of great severity. On two occasions the acute syndrome developed in young mothers two to three weeks after they commenced carrying the baby around on their left arm. On one occasion it appeared within a few hours after a young woman sharply rotated her head to scold a child and experienced a sensation of tightness in the right side of her neck. In another instance a woman started a course in plastic molding that required an unusual amount of muscular exertion. A few hours after her first lesson intense diffuse pain and muscle spasm developed throughout the arm. Nine patients have been observed with the acute syndrome and in eight the symptoms were apparently induced by trauma. The ninth patient was a woman fifty-two years of age with rheumatic heart disease and recurring episodes of acute intramuscular fibrositis involving various portions of the body. On one occasion the muscles of the right side of the neck (trapezius, sternocleidomastoid and scaleni) were involved, and diffuse pain throughout the arm, spasm of the biceps and triceps and weakness of extensors of the wrist occurred. The tenderness and spasm of the sternocleidomastoid and trapezius were not relieved with procaine injection into the scalenus anterior, but the diffuse pain and muscular spasm in the arm were abolished. All of the nine patients seen with the acute syndrome have had a palpably enlarged, tender, scalenus anticus muscle, and they have all responded satisfactorily to cessation of muscular activity, the application of heat to the neck, short wave diathermy, support of the extremity in a sling and in most instances injections of 1 per cent procaine hydrochloride into the scalenus anticus muscle. In two of the nine patients the injection of procaine was not performed. The following case history illustrates the acute syndrome:

A twenty-four year old married primipara was delivered of a boy on June 5, 1948. No postpartum complications occurred, and the patient experienced no pain in the left arm until she had returned home and had assumed the care of the baby for a week. At this time she experienced over the course of a few hours a progressively more disturbing numbness in the tips of all fingers, a diffuse aching in the forearm and heaviness throughout the entire arm. The discomfort was moderate during the early hours of the succeeding few days, by evening it was rather intense and during the night it frequently aroused her from sleep. Rest was obtained only after the ingestion of codeine. During the day she could obtain some relief by supporting her left forearm with her right hand and by resting her left hand on the top of her head. At the time of examination ten days after the onset there was hyperesthesia over the finger tips, no other sensory change, no motor weakness, moderate spasm of the muscles of the forearm, no tenderness around the shoulder joint and an enlarged, tender, scalenus anticus muscle on the left. Gentle pressure on the muscle accentuated the pain and hyperesthesia in the extremity. There was no difference in the temperature of the skin of the two hands. Pulse amplitude of the radial arteries was equal to palpation. There was a diminution of the oscillometric index from 1.4 to 0.7 on the left with rotation of the head to the left and extension of the neck. No change in the index was observed on the right side when the corresponding maneuver was performed. Roentgen examination of the cervical spine demonstrated no cervical rib, arthritis or anomaly of the first rib. The patient was advised to apply heat to the neck and to carry the baby with the right arm temporarily and then to alternate arms. There was a progressive subsidence of all pain and paresthesias during the ensuing ten days.

The chronic stage of this disorder has frequently in our experience been the result of repeated prolonged exertion involving the musculature of the neck and shoulder regions. One patient employed by a tailoring establishment did nothing but repeatedly lift a heavy iron with his right hand. In another patient, a nurse, a bilateral syndrome developed a few weeks after the patient started to care for a complete invalid whom she had to lift several times daily.

One of the features of this disease that leads to easy misinterpretation is the presence of a traumatic myositis involving muscles other than the scalenus anticus. The other muscles commonly associated with spasm of the scalenus anticus are the trapezius, deltoid, rhomboids and pectoralis major. The myositis of the scalenus produces the characteristic neurologic and vascular manifestations in the extremity. The pain and tenderness originating in the other muscles will not, of course, be relieved with either the injection of procaine hydrochloride into the scalenus or by a scalene tenotomy. Scalenotomy for the relief of pain in the upper extremity may be justified in these circumstances, but the patient should be forewarned that all symptoms will not disappear. It has been our experience that after the pain in the upper extremity has been relieved by operation, the pain arising in other muscles assumes much greater importance to the patient. After one such instance we have been reluctant to operate upon those patients who present evidence of a diffuse myositis of the neck and shoulder. This condition must be carefully differentiated from the superior type of scalenus anticus syndrome described by Swank and Simeone. In the latter there may be pain and tenderness in many of the muscles of the shoulder girdle, presumably from the muscular spasm, secondary to pressure by the scalenus anticus on the roots of the fourth, fifth and sixth cervical nerves. The injection of procaine hydrochloride into the scalenus muscle will alleviate this type of pain and differentiate it from a traumatic or inflammatory myositis involving the same muscles.

The diagnosis of the scalenus anticus syndrome is not difficult provided the physician keeps the disease in mind. The diagnostic tests which we believe are of value are local tenderness of the belly of the scalenus anticus, the relief of pain following the injection of procaine into the muscle and the Adson maneuver. The recording of oscillometric indices during the Adson maneuver is of assistance in some instances provided there is no cessation of respiration.

There are two aspects of these tests that may be easily misinterpreted. During the course of performing the Adson maneuver on a patient who complained of diffuse aching in the left arm and coldness of the left hand it was noted that the oscillometric index on the left side

became 0 when the head was rotated to either left or right whereas the index on the right side became 0 only when the head was rotated to the right. These observations led to a recording of the oscillations in the lower extremities, and it was found that they also were reduced to 0 when the head was rotated to the right, but that there was no change when rotation of the head to the left was carried out. A hyperactive carotid sinus on the right accounted for the observations. A diagnosis of left scalenus anticus syndrome was made, and the patient obtained complete relief from a scalenotomy. Such circumstances will be encountered infrequently; but when bizarre reductions in the pulse amplitude, blood pressure or oscillogram occur, a hypersensitive carotid sinus should be considered.

Another unusual feature of the diagnostic tests concerns the injection of procaine hydrochloride into the muscle. Occasionally a patient is encountered who has vascular changes in the extremity not only when the arm is in certain positions or during the diagnostic maneuvers but also at all times presents evidence of a constant reduction in arterial circulation. In these circumstances the patient may not be completely relieved with the intramuscular injection of procaine, but may require infiltration of the stellate ganglion as well. Such a condition could arise when there has been sufficient irritation of postganglionic fibers from the stellate ganglion to the brachial plexus so that the mere relief of pressure does not abolish the irritation, and complete paralysis of the sympathetic fibers is necessary to permit vasodilatation. Our limited experience does not allow us to state whether scalenotomy alone would ultimately relieve a chronic arteriospasm of this nature. When stellate ganglion block with procaine has been necessary to abolish arteriospasm we have felt justified in performing an anterior preganglionic thoracic sympathectomy according to Telford's method[4] simultaneously with the scalenotomy. The following case history illustrates such a situation:

J. S., a thirty-two year old male was admitted to the hospital in October, 1946, complaining of pain of a dull, aching character in the right arm and hand and around the right scapula. The pain had been present for sixteen months, at first intermittently and for the past six months constantly. He had also observed that his right hand was colder than his left and that all symptoms were accentuated by exposure to cold. He had had ulceration at the tip of two fingers of the right hand which had healed slowly but spontaneously. Examination showed slight tenderness of the scalenus anticus muscle, and local pressure accentuated the pain in the arm. The Adson maneuver was negative. The right hand was paler than the left and cooler to palpation. The temperature of the right hand was consistently 2 to 4°C. lower than that on the left. Two injections of procaine hydrochloride into the scalenus anticus muscle gave considerable but incomplete relief of pain. Fifteen minutes after each injection the stellate ganglion was infiltrated with 8 ml. of 1 per cent procaine hydrochloride. Complete vasodilatation in the hand resulted, and all pain disappeared. At operation the scalenus anticus muscle was enlarged, and after tenotomy there was an obvious release of the subclavian artery and rotation of the brachial plexus. A thoracic sympathectomy was performed through the same incision. The rami of the second and third ganglia were incised; the sympathetic chain was cut below the third ganglion and the cephalic end brought up into the wound. His postoperative course was uncomplicated. Complete relief of pain resulted immediately and has persisted for two and a half years.

The operation of scalenotomy is performed with minor variations according to the technic advocated by Adson.[5] We have found it necessary to incise the clavicular insertion of the sternocleidomastoid muscle only when a thoracic sympathectomy is simultaneously performed. The omohyoid has frequently been found to be enlarged and taut. When so encountered it is incised and not resutured. In certain instances the cervical fascia posterior to the scalenus anticus muscle may contribute to pressure upon the brachial plexus. Whenever it is found to be tense or fibrotic, it should be incised transversely.

During the course of these operations three complications were encountered. The pleura was inadvertently opened on one patient. A saline sponge was placed over the opening. Aside from a mild subcutaneous emphysema lasting a few days postoperatively no difficulty resulted. In one other patient, during the course of the dissection, lymph appeared in the wound. The opening in the lymphatic vessel was

identified, clamped and ligated, but it was not possible to identify this vessel as thoracic duct. No incisional lymphedema or lymphorrhea developed.

One other complication of the operation to which Adson[5] has alluded was spontaneous rupture of the subclavian artery. It occurred to one of us (W. D. H.) not during the course of a scalenotomy but on exploration of the brachial plexus for post-traumatic pain and paralysis of the upper extremity. Since the operative approach is the same for the two procedures, it does not seem out of place to mention it here. The patient was a fifty-two year old man with moderate generalized arteriosclerosis. He had experienced a wrenching injury of the right upper extremity which resulted in a flaccid paralysis of the extensors of the hand and fingers and severe pain and coldness of the hand. It was our intent to explore the brachial plexus and simultaneously perform an anterior thoracic sympathectomy. The patient was placed on his back and given a gas-oxygen-ether anesthetic. The neck was extended and the head rotated slightly to the left. A 12 cm. right supraclavicular incision was made through the skin. As soon as the platysma was incised, there was a rush of arterial blood from the depths of the wound. The bleeding was controlled with digital pressure with considerable difficulty only after an abundant loss of blood. The cervical fascia was incised and the scalenus anticus muscle transected. The subclavian artery was found to be directly under the thumb producing pressure. A hemostat was placed proximally on the artery and the pressure removed. It was found that the thyrocervical axis had torn off the subclavian artery so that repair was impossible. Ligations of all vessels were carried out, and it was noted that the walls of the artery were extremely fragile and brittle. Fifteen hundred ml. of whole blood were given the patient during the operation. The patient died six months later from causes unassociated with the injured arm, and a section of the subclavian artery showed a severe degree of arteriosclerosis with extensive calcification to be present. We have had difficulty accounting for this fracture of the artery at the time of operation. The only predisposing factor that we can ascribe to the accident is hyperextension of the neck and rotation of the head putting undue tension on a badly diseased subclavian artery.

In this series of patients two operative failures have occurred. Both patients were re-explored and, unfortunately, completely satisfactory explanations for the cause of recurrence were not forthcoming. Pain may persist or recur after a scalenotomy because of an incorrect diagnosis, failure to transect the whole muscle, trauma to the brachial plexus, perineural fibrosis and failure to recognize chronic arteriospasm that requires a sympathectomy for relief. The following abbreviated history illustrates two of the aforementioned causes of failure:

Mrs. M. G. was admitted to University Hospitals on December 30, 1946, complaining of pain in the third and fourth fingers of the left hand, in the left forearm and left side of the neck. Her symptoms started one week after a fall during which she was caught by the left arm and partially supported. Her symptoms were more prominent in cold weather. Examination showed hyperesthesia of the left hand over the distribution of the ulnar nerve. There was moderate atrophy of the small muscles of the left hand. There was a diminished skin temperature and increased sudomotor activity of the left hand compared with the right. The left scalenus anticus muscle was enlarged and tender. A procaine injection of the muscle afforded complete relief of pain. She was discharged on December 31, 1946, and readmitted on January 26, 1947. The following day a left scalenotomy was performed without complication; and when the patient recovered from the anesthetic the aching had disappeared from the upper extremity. The remission of symptoms persisted until the last week of February, 1949, when over the course of a few days the same syndrome reappeared. The patient was readmitted to University Hospitals on March 22, 1949, and findings similar to those previously recorded were noted. A stellate ganglion infiltration with procaine hydrochloride afforded immediate relief of all symptoms. The left supraclavicular fossa was explored on March 24, 1949. A band of muscle about 4 to 5 mm. in diameter was encountered where the scalenus anticus muscle ordinarily would have been found. This band was taut and free of fibrosis. It was sectioned transversely and the two ends retracted 2 to 3 cm. The cephalic end of the previously transected portion of the scalenus anticus muscle could be palpated high in the neck above the brachial plexus and was not

thought to be contributing to the recurrence of symptoms. The small muscle band that was found and cut could only have been a portion of the scalenus anticus that was not recognized at the initial operation. Since a definite mechanism for producing pressure on the brachial plexus was encountered and eliminated, it was considered unlikely that a thoracic sympathectomy would be of any more assistance. Consequently the wound was closed. For about one week following the operation all pain in the hand and arm disappeared. Thereafter, however, the symptoms returned in a pattern similar to that noted before.

It is difficult to explain the failure of the last exploration of the supraclavicular fossa. There was little fibrosis remaining from the original operation. Nothing remained, after section of the remnant of muscle, that could cause pressure on the anterior surface of either the brachial plexus or subclavian artery. Both were completely visualized and found to be free of pressure. No hematoma that might have been a source of pressure developed during the postoperative period. It is possible that the prolonged pressure exerted upon the brachial plexus produced sufficient perineural inflammation to cause a persistence of symptoms. Six weeks following the operation priscol was administered orally with partial relief, but it is expected that the ultimate satisfactory solution of this patient's difficulty will only follow a thoracic sympathectomy.

SUMMARY

Forty-two patients with forty-five scalenus anticus syndromes have been reviewed. The syndrome may be divided into an acute and chronic stage; the former in general responds to conservative therapeutic measures and the latter for the most part must be treated with scalenotomy. Muscular exertion stands out as a precipitating factor in the pathogenesis of the syndrome. Traumatic myositis of muscles of the shoulder girdle and neck must be differentiated from the superior type of scalenus anticus syndrome described by Swank and Simeone. The injection of procaine hydrochloride into the scalenus anticus muscle should not anesthetize the stellate ganglion until relief of pain from the intramuscular injection can be evaluated. If the relief of pain is not satisfactory following the intramuscular procaine injection, the stellate ganglion should be infiltrated. If relief of pain then is obtained and operative correction is contemplated, a thoracic sympathectomy should be performed simultaneously. A discussion of operative complications and postoperative recurrences is included.

REFERENCES

1. Adson, A. W. and Coffey, J. R. Cervical rib. *Ann. Surg.*, 85: 839, 1927.
2. Ochsner, A., Gage, M. and DeBakey, M. Scalenus anticus (Naffziger) syndrome. *Am. J. Surg.*, 28: 669, 1935.
3. Swank, R. L. and Simeone, F. A. Scalenus anticus syndrome. *Arch. Neurol. & Psychiat.*, 51: 432, 1944.
4. Telford, E. D. Technique of sympathectomy. *Brit. J. Surg.*, 23: 448, 1935.
5. Adson, A. W. Surgical treatment for symptoms produced by cervical ribs and scalenus anticus muscle. *Surg., Gynec. & Obst.*, 85: 687, 1947.

EFFECTS OF LOCAL ALKALINE PHOSPHATASE IN EXPERIMENTALLY PRODUCED FRACTURE IN THE RABBIT*

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THIS experimental work was undertaken to evaluate the part played by a dried extract of bone alkaline phosphatase in the healing of experimentally produced fractures in the rabbit.

Many authors, notably Robison,[1] have produced reliable evidence showing that the enzyme alkaline phosphatase plays an important role in the calcification of bone. The presence of the enzyme phosphatase causes a local increase of phosphate by a hydrolytic process acting on the organic bound phosphoric acid esters of the plasma. The solubility produce of calcium phosphate is exceeded at the site of the fracture causing deposition of calcium in the bone matrix by precipitation. Robison[2] also produced calcification experimentally in rachitic bone which had been immersed in a solution of glycerophosphates and hexosephosphates.

Numerous studies have shown that fractures physiologically stimulate phosphatase activity. In 1935 Botterell and King[3] found that the phosphatase content of callus and bone in the region of healing experimentally produced fractures was higher than that of normal bone and that the increase persisted for fifty to sixty days. Hunsberger and Ferguson[4] observed an increase of phosphatase in the serum of patients with fractures. George[5] found a definite rise in phosphatase activity in the blood serum of cats with healing fractures. Bone phosphatase initially showed activity the fourth and fifth days followed with a decrease on the sixth day, then a recurrence of activity reaching its height on the twelfth day and continuing well sustained.

Effort has been directed toward stimulating osteogenesis by prepared materials. Bisgard and Macumber[6] placed bone ash in defects in the radius of rabbits and reported that there is no evidence that this aids in the repair of bone. Orel[7,8] used os purum and os novum as bone implants with effectiveness. Albee and Morrison[9] in 1920 placed 1 cc. of a 5 per cent solution of triple calcium phosphate in radial defects of animals and observed some stimulation of bone healing.

Key[10] studied the effect of a local calcium deposit on osteogenesis and healing of fractures by placing calcium phosphate and carbonate in the proportion in which they occur in bone and bone powder, made by removing the organic matter, in defects in the ulna of dogs, and found very little stimulation of osteogenesis. Shands[11] in a study of bone formation in 1937 showed that calcium salts deposited at the site of a bone defect stimulated bone formation. Blum[12] in 1944 found that phosphatase and glycerophosphate stimulate the repair of experimental bone gaps in rabbits and, also, that ectopic bone was formed in muscles by introduction of this substance by injection. Drummond et al.[13] reported that the levels of phosphatase and calcium in infected fractures in rabbits were lower than in sterile fractures and that high levels of phosphatase activity were associated with the presence of large calcium deposits.

Roe and Whitmore,[14] Gomori[15] and Lorch[16] reported the importance of alkaline phosphatase in the mechanism of calcification.

PLAN OF EXPERIMENT

The purpose of this experiment was to determine the effect of a dried extract of bone alkaline phosphatase on the rate of callus formation when placed in an experimentally produced defect in the radius of a rabbit.

Twelve adult rabbits were used. Their ages were not determined except that all were young adults. The rabbits were maintained on a regular diet consisting of commercially prepared rabbit food with the addition of green leafy vegetables each day. (Table 1.)

* From the Alfred I. Dupont Institute, Wilmington, Del., and The Hospital of the University of Pennsylvania, Department of Orthopedic Surgery, Philadelphia, Pa.

TABLE 1

No.	Surgery	Weight of Powder (mg.)	1st X-ray	2nd X-ray	3rd X-ray	Results
1	3/23/48	20	3/23, both bones of right forearm fractured	.....	.....	Discarded because both bones of right forearm fractured during surgery
2	3/27/48	20	Section 5 mm. removed from midshaft of radius, bilateral	4/20, moderate increase in calcification at site of phosphatase deposit	5/11, both radii show good union	Moderate increase in calcification at site of phosphatase deposit
3	3/31/48	20	Section 7 mm. removed from radius, bilateral	4/20, marked increase in calcification at site of phosphatase deposit	5/11, marked increase in calcification at site of deposit; good union	1 mo. following surgery marked increase in calcification at site of phosphatase deposit
4	4/5/48	20	Section 10 mm. removed from radius, bilateral	4/20, slight increase in calcification at site of phosphatase deposit	5/11, slight increase in calcification at site of phosphatase deposit	Slight increase in calcification at site of phosphatase deposit 15 and 35 da. following surgery
55	5/31/48	25	Section 10 mm. removed; both radii, bilateral	6/14, slight increase in calcification at site of phosphatase deposit	6/29, no change	Slight increase in callus 14 da. at site of phosphatase deposit; otherwise no change
57	5/31/48	25	Section 9 mm. removed from radii, bilateral	6/14, slight increase in calcification opposite side	6/29, no change	Here no result was noted; slight decrease of calcification opposite side
58	6/1/48	25	Section 7 mm. removed; both fractured on right	6/14, no change	6/29, more callus, right	Because both bones fractured on right result could not be accurately interpreted
59	6/1/48	25	Section 10 mm. removed from radii, bilateral	6/14, marked increase in calcification at site of phosphatase deposit	6/29, marked increase in calcification at site of phosphatase deposit	Marked increase in callus at site of phosphatase deposit
60	6/1/48	25	Section 9 mm. removed from radii, bilateral	6/14, no change	6/29, slight increase in callus at site of phosphatase deposit	Slight increase in callus at site of phosphatase deposit
64	5/31/48	25	Section 9 mm. removed from radii, bilateral	6/14, marked increase in callus at site of phosphatase deposit	6/29, moderate increase in callus at site of phosphatase deposit	Moderate increase in callus at site of phosphatase deposit
71	5/31/48	25	Section 9 mm. removed from radii, bilateral	6/14, slight increase in calcification at site of phosphatase deposit	6/29, union slightly denser at site of phosphatase deposit	Slight increase in calcification at site of phosphatase deposit
72	6/1/48	25	Section 8 mm. removed from radii, bilateral	6/14, slight increase in calcification at site of phosphatase deposit	6/29, no change	Slight increase 2 wk. in calcification at site of phosphatase deposit

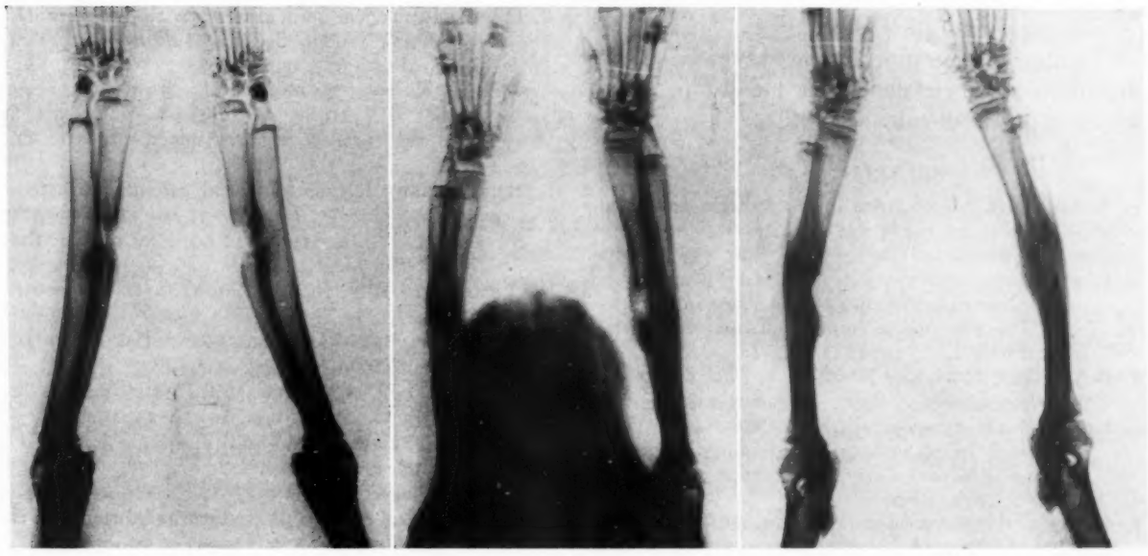

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FIG. 1. Slight increase in callus and calcification two weeks following deposition of phosphatase in defect in right radius.
FIG. 2. Moderate increase in callus and calcification two weeks following deposition of phosphatase in radial defect on right.
FIG. 3. Marked increase in callus and calcification four weeks following deposition of phosphatase in radial defect on right.

Sodium phenobarbital was used as an anesthetic given by the intravenous route in the ear vein. Under sterile conditions an incision was made over the posterolateral aspect of the left forearm and the radius isolated, the periosteum carefully dissected and a portion of bone averaging from 5 to 10 mm. excised by means of an electric bone saw. An identical procedure was carried out on the right forearm except that 20 to 25 mg. of the prepared powder of alkaline phosphatase were inserted into the bone defect. The phosphatase powder was mixed with blood obtained from the operative site and the soft semi-solid mixture inserted into the bone defect. The subcutaneous tissue and skin were closed with silk suture. A collodion dressing which served as a splint was applied. The animals were checked postoperatively by roentgenograms and at intervals of two weeks and one month.

PREPARATION OF BONE PHOSPHATASE[17]

Extraction of Phosphatase. The bones of young growing rabbits are removed immediately after death, freed from muscle and connective tissue and split longitudinally. The marrow is removed and the bones with their epiphyses are cut into small pieces. Place bone in flask with five times weight of HOH to which a few drops of chloroform have been added. Keep flask closed at room temperature eight days and shake each day. Add fresh chloroform if necessary. Filter extract (coarse filter paper).

Purification. Precipitate the filtrate extract with a mixture of alcohol and ether (200 cc. alcohol and 300 cc. ether for each 100 cc. extract). Shake for a few minutes until a flocculent precipitate forms. Filter through a Buchner funnel and wash with absolute alcohol. Dry in an evacuated desiccator (an almost colorless powder should be obtained weighing 3 to 4 mg. per cc. extract).

Further Purification. Extract mixture with 50 per cent alcohol. Reprecipitate by a further addition of alcohol and ether.

RESULTS

Two animals in the series were discarded because both forearm bones were fractured during the initial surgery.

Of the ten animals studied, five showed a slight increase of calcification at the site of the phosphatase deposit, two showed a moderate increase of calcification and two a marked increase in calcification. (Figs. 1 to 3.) One animal showed no change.

SUMMARY

This study indicates that the enzyme alkaline phosphatase when deposited locally in bone defects stimulates calcification.

REFERENCES

1. Robison, R. Significance of Phosphoric Esters in Metabolism. New York, 1932. New York University Press.
2. Robison, R. and Soames, K. M. The possible significance of hexosephosphoric esters in ossification. The phosphoric esterose of ossifying cartilage. *Biochem. J.*, 18: 1152, 1924.
3. Botterell, E. H. and King, E. J. Phosphatase in fractures. *Lancet*, 1: 1267, 1270, 1935.
4. Hunsberger, Ambrose and Ferguson, L. Kraeer. Variations in phosphatase and inorganic phosphorous in serum during fracture repair. *Arch. Surg.*, 2: 1052, 1932.
5. George, Everett Moore. Phosphatase activity in blood serum. *Arch. Surg.*, 57: 113, 1948.
6. Bisgard, J. Dewey and Macumber, Harold H. Influence of bone ash on repair of bone. *Arch. Surg.*, 40: 984, 1940.
7. Orell, S. Use of "os purum" in bone implantations with special reference to its use in tubercular bone and joint lesions. *Surg., Gynec. & Obst.*, 66: 23–36, 1938.
8. Orell, S. Surgical bone grafting with "os purum," "os novum" and boiled bone. *J. Bone & Joint Surg.*, 19: 873–885, 1937.
9. Albee, F. and Morrison, J. Studies in bone growth with triple calcium phosphate as a stimulus to osteogenesis. *Animal Surg.*, 81: 32, 1920.
10. Key, Albert J. Effect of local calcium on osteogenesis. *J. Bone & Joint Surg.*, 16: 176, 1934.
11. Shands, A. R., Jr. Studies in bone formation: the effect of the local presence of calcium salts on osteogenesis. *J. Bone & Joint Surg.*, 19: 1065–1076, 1937.
12. Blum, George. Phosphatase and the repair of fractures. *Lancet*, 2: 75–78, 1944.
13. Drummond, D. H., Tollman, J. P., Bisgard, J. D. and Ross, D. *Arch. Surg.*, 40: 49–53, 1940.
14. Gomori, G. Calcification and phosphatase. *Am. J. Path.*, 19: 197–207, 1943.
15. Roe, J. H. and Whitmore, R. Clinico-pathologic application of serum phosphatase determinations with special reference to lesions of bones. *Am. J. Clin. Path.*, 8: 233–254, 1938.
16. Lorch, I. J. Alkaline phosphatase and the mechanism of ossification. *J. Bone & Joint Surg.*, 31: 94–99, 1949.
17. Martland, M. and Robison, R. Preparation and use of bone phosphatase. *Biochem. J.*, 23: 237, 1929.

CHOLELITHIASIS IN CHILDHOOD

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THE incidence of cholelithiasis in children is not the rare occurrence it was once considered to be. A review of the literature discloses reports of a surprisingly large collection of cases by Potter[1] and others (Sallick,[2] Seidler and Brakely[3]). This report of a case and review of the literature is made with a view toward adding to the weight of evidence that cholelithiasis is a disease to be considered in the differential diagnosis of the acute or chronic surgical condition within the abdomen in children.

Roentgenographic study should be encouraged in all obscure abdominal conditions in childhood; cholecystography is well tolerated by children and its more frequent use undoubtedly would uncover many more cases of cholelithiasis.

The similarity between the symptoms of acute appendicitis and cholelithiasis is somewhat confusing, and during the operation for appendicitis the gallbladder should be palpated for calculi if possible.

Dr. Sallick's[2] paper on the subject of cholelithiasis suggests that the condition be classified into three varieties, namely, malformations, inflammations and those of metabolic origin. In infancy and very early childhood biliary disease may be due to malformations of the biliary passages with atresia or absence of one or more components of the system. Stagnation of bile due to mechanical factors plays an important role in the formation of concretions which may form in the biliary system. Inflammation of the gallbladder in later childhood with either suppuration or spontaneous recovery does not usually give rise to the formation of calculi. There is finally that type of cholecystitis and cholelithiasis similar to that which occurs in adult life and is usually regarded to be of a metabolic nature. Congenital abnormalities as a rule are not helped by surgery. The second type usually recovers without the necessity of an operation and the third or adult type is treated with cholecystectomy.

The incidence of the disease in children is more evenly distributed between the sexes than it is in the adult form of cholelithiasis, the occurrence in females being only slightly higher than it is in males. The cases reported further reveal that the disease occurs more frequently in older than in younger children, the number of patients above eight years being more common than below this age. There are congenital biliary conditions not considered in this discussion of cholelithiasis which would, however, make the frequency of biliary tract disease more common in the first few years of life, but these cannot be considered as true cases of cholelithiasis as presented herein.

The etiologic factors in the formation of biliary concretions are commonly agreed upon by most surgeons who report these conditions. Acute exanthemas and respiratory infections probably play a role in the pathologic process. Typhoid fever, which was once considered a major etiologic factor, has diminished in importance due to improvements in sanitation, and the infrequency of typhoid has not diminished the occurrence of cholelithiasis. In Lowenburg and Mitchell's[4] series five patients had an associated upper respiratory tract infection. Lamblia infestation has been found by a number of surgeons; Smithies[5] found this parasite in biliary drainage (1928) and Zelditch[6] also reported twelve cases of biliary tract infestation. These, however, were not all cases with accompanying cholelithiasis. Extrahepatic biliary obstruction due to compression by adjacent structures such as lymph nodes definitely plays a part in the stagnation of bile and the formation of biliary concretions. These nodes are usually situated at the junction of the cystic and common bile ducts and were found in several of the cases reported, as well as in the case herein presented.

CASE REPORT

R. J. (No. 86735), a seven year old white female, was admitted to the Little Company of Mary Hospital with the complaint of upper abdominal pain and nausea after meals. The mother stated that the distress seemed to follow meals rich in fatty and spicy foods.

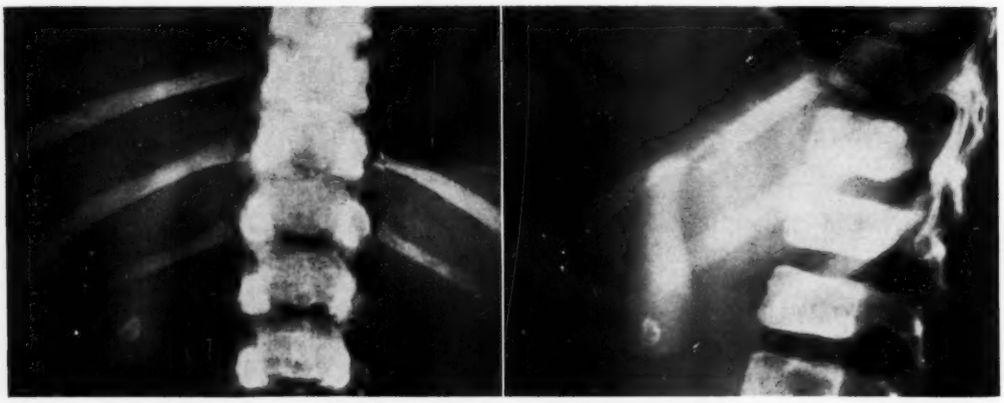

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FIG. 1. Anteroposterior view reveals a radiopaque calculus in the fundus of the gallbladder.
FIG. 2. Lateral view reveals a gallbladder filled with dye and a radiopaque calculus in the fundus of the gallbladder.

This condition had frequently occurred for the past two and a half years. The attacks lasted for from several hours to several days and consisted of epigastric pain and tenderness over the entire upper abdomen and were accompanied with nausea and vomiting. No chills, fever or jaundice seemed to accompany the attacks.

Physical examination was essentially negative with the exception of slight tenderness on deep palpation over the upper right abdomen. The laboratory examination was essentially negative.

Anteroposterior and lateral cholecystograms revealed a gallbladder filled with dye and a radiopaque calculus was shown in the fundus of the gallbladder. (Figs. 1 and 2.) The roentgenographic diagnosis was cholelithiasis.

A cholecystectomy was performed through a right paramedian incision. The abdomen was closed without drainage and the patients postoperative course was uneventful. The follow-up, covering two years, disclosed complete cessation of all of the patient's previous symptoms.

On pathologic examination the specimen consisted of a gallbladder 5.6 by 3.2 cm., the walls 2 mm. thick. The serosa was red and the mucosa thickened. There was a black bilirubin stone impregnated with calcium 8 by 5 mm. The diagnosis was cholelithiasis and active chronic cholecystitis.

COMMENT

The earliest published record of cholecystitis in childhood was made by Gibson[7] in 1722. Still[8] reported twenty cases occurring between 1722 and 1899. His cases were instances of cholelithiasis. In 1923 Kellogg[9] compiled a total of sixty-four cases of reported gallbladder disease in children. By 1928 Dr. Beals[10] brought the compiled total of instances of gallbladder disease in children to 124. In 1928 Potter[1] reported having uncovered 226 cases of cholecystitis in subjects under fifteen years of age. This total was raised to 432 by Potter[11] ten years later. A critical analysis of Potter's cases, however, reveals that in nearly one-third of the total number the conditions reported were congenital abnormalities of the biliary tract. Many cases such as hemolytic jaundice, blood dyscrasias and foreign bodies in the biliary tract were those not considered the type of gallbladder disease as reported herein. Of all the reported cases, cholecystectomy was performed upon only thirty-five patients.

Cholelithiasis in childhood is usually associated with symptoms similar to those as found in the adult, and its treatment is cholecystectomy. In the past twenty years case reports of this condition, have occasionally been presented in the literature. These add to the evidence that although uncommon the occurrence of gallstones in children must be considered in the examination of the child with acute or chronic recurrent abdominal distress.

REFERENCES

1. POTTER, A. H. Gallbladder disease in young subjects. *Surg. Gynec. & Obst.*, 46: 795, 1928.
2. SALLICK, MYRON A. Cholecystitis and cholelithiasis in childhood. *J. Mt. Sinai Hosp.*, 9: 963, 1943.

3 SEIDLER, V. B. and BRAKELY, E. Gallstones in children. *J. A. M. A.*, 114: 2082, 1940.
4. LOWENBERG, HARRY, JR. and MITCHELL, A. G. Cholecystitis in childhood. *J. Pediat.*, 12:203, 1938.
5. SMITHIES, FRANK. Present day treatment of intestinal protozoiasis. *J. A. M. A.*, 91: 159, 1928.
6. ZELDITCH, WURMANN, JOLKVER and GUINDITCH. Des cholécystites chez les enfants. *Rev. franc. de pêdiat.*, 12: 351, 1936.
7. GIBSON, J. Medical Essays and Observation. London, 1722.
8. STILL, G. F. Biliary calculi in children. *Tr. Patb. Soc.*, 50: 151, 1899.
9. KELLOGG, E. L. Gallbladder disease in childhood. *Ann. Surg.*, 77: 587, 1923.
10. BEALS, T. A. Cholecystitis and cholelithiasis in children. *Soutb. M. J.*, 21: 666, 1928.
11. POTTER, A. H. Biliary disease in young subjects. *Surg., Gynec. & Obst.*, 66: 604, 1938.
12. LEVINE, S. Z., MATTESON, SARAH and DALE, JOHN H. Cholelithiasis in childhood. *Am. J. Ped.*, 34: 777, 1949.
13. HERINGMAN, E. CRAIG and AIKEN, DAVID W. Cholecystitis and cholelithiasis in the young. *Am. J. Surg.*, 74: 27, 1947.

CYANOSIS in patients with congenital heart lesions can often be relieved by surgery. This is especially true in patients with pulmonary stenosis. However, not all patients require operation. If such a cyanotic child has a large heart or a prominent pulmonary conus, with visible pulsations in the lungs as seen by fluoroscopy, then surgery is not indicated. However, if such a child presents the typical tetralogy of Fallot, right axis deviation on electrocardiographic examination and an absence of visible pulsations in the hilar lung areas, an aortic-pulmonary anastomosis is often very beneficial. The operation requires the presence of an experienced vascular surgeon but in such hands the results are good and operative mortality is about 15 per cent. Equally good results occur when this operation is done upon children with stenosis of the tricuspid valve. Optimum results occur in patients operated upon between the ages of three and seven years. (*Richard A. Leonardo, M.D.*)

OBSTRUCTION OF THE ALIMENTARY TRACT FROM GALLSTONES*

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THE purpose of this paper is to emphasize the frequency with which gallstones ulcerating into the gastrointestinal tract produce acute obstruction. In a personal series of 130 consecutive cases of acute intestinal obstruction gallstones were responsible in four instances. A fifth patient was seen with intermittent pyloric obstruction due to a large intragastric gallstone. All patients made a satisfactory recovery following surgery.

TABLE I
INCIDENCE OF INTESTINAL OBSTRUCTION DUE TO GALLSTONES

Author	Total Obstructions	Gallstone Obstructions	Per cent
Osler[24]	295	23	7.8
Barnard[3]	669	14	2.1
Souttar[30]	1,655	28	1.7
Bennett[4]	3,064	28	0.9
Leichtenstern[16]	1,152	41	3.5
Powers[25]	179	4	2.2
Vick[31]	3,625	47	1.3
Meyer and Spivack[20]	502	2	0.4
Balch[2]	502	10	2.0
McQueeney[23]	7,232	149	2.0
Mayo, Miller and Stalker[19]	136	2	1.5
Rigler, Borman and Noble[27]	404	11	2.7
Hand and Gilmore[11]	147	3	2.0
McLaughlin and Raines	130	4	3.1
	19,692	366	1.9

The incidence of acute intestinal obstruction due to gallstones is tabulated in Table I. A compilation of reported series indicates that larger gallstones are responsible for from 1.5 to 3 per cent of all cases of acute intestinal obstruction.

Clinically the usual patient is an obese female in the sixth or seventh decade of life.[23] Wakeley and Wilway[34] state that there is a history of biliary disease in from 30 to 50 per cent of the cases while others report that a previous history of biliary disease is infrequent[3,4,21] In our five patients there was a definite previous history of gallbladder disease in four instances and a suggestive story in the fifth.

TABLE II
INCIDENCE OF SPONTANEOUS INTERNAL BILIARY FISTULAS

Author	Post-mortem Examinations	Surgical Examinations	Per cent
Roth, Schroeder and Schloth[28]	10,866	.....	0.39
University of Minnesota Hospitals	19,478	.....	0.12
Kehr[15]	.....	2,000	5.00
Bernhard[5]	.....	6,263	1.80

Occasionally one can obtain a history of a previous illness suggesting empyema of the gallbladder with abrupt spontaneous recovery without surgical intervention. Such a history was present in two of our patients. Subsequently symptoms of high intestinal obstruction develop with intermittent periods of remission, and ultimately a complete low small bowel obstruction occurs. An interval of a few days or many months may elapse between the acute biliary episode and the final intestinal obstruction.

In practically all cases gallstone obstruction is preceded by the formation of a fistula between the biliary system and the gastrointestinal tract.[23,24] That such fistulas are not uncommon is demonstrated in Table II.

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Although such fistulas usually result from the erosion of gallstones, peptic ulcer is sometimes the etiologic factor, and more rarely malignancy. X-ray evidence of fistulas may be simulated by regurgitation of air or contrast media through an incompetent sphincter of Oddi. Biliary emphysema has been observed from bacterial action.[7]

Intestinal obstruction most frequently follows the formation of a cholecystoduodenal fistula and discharge of a large stone into the small bowel. Cholecystogastric and cholecystocolic fistulas are infrequently associated with acute obstruction from gallstones.

Calculi that produce intestinal obstruction are usually 2.5 cm. in diameter or larger.[3,27,34] Smaller stones may remain in the lumen of the bowel or lodge in the bowel wall for many years growing by accretion.[22] Probably over 50 per cent of gallstones large enough to produce obstructive symptoms pass through the alimentary tract without causing complete obstipation.[10,18] Intragastric gallstones may produce intermittent pyloric obstruction similar to that seen with a pedunculated polyp as observed in Case v. The most frequent sites of impaction in the order of frequency are the ileum, ileocecal area, colon, duodenum and jejunum.

A diagnosis of intestinal obstruction resulting from a gallstone is too often made late in the illness. The age and obesity of the patient with intermittent bouts of partial intestinal obstruction with frequent intermissions contribute to the problem.

Until recent years x-ray has been useful only in making a diagnosis of intestinal obstruction in these cases since the stones are rarely radiopaque. Prior to 1935 only seven cases of gallstone obstruction were correctly diagnosed by x-ray before surgery.[7] Radiologists now suggest a scout film of the abdomen in suspected cases followed by anteroposterior and lateral films of the right upper quadrant to demonstrate possible biliary emphysema. In the absence of air in the biliary tree a swallow of thin barium by mouth may fill the bile ducts or gallbladder or possibly even show a filling defect in the small bowel.[7]

The demonstration of gallstones in the vomitus or stools of patients with suspected intestinal obstruction is rarely observed but almost diagnostic. One patient in our series vomited two facetted gallstones after admission, making an accurate preoperative diagnosis possible.

Treatment demands prompt correction of fluid and electrolyte balance, intestinal intubation and surgery as soon as distention is overcome. In the majority of instances exploration will be undertaken with a diagnosis of small bowel obstruction from unknown cause. On finding an impacted gallstone it is desirable to move it proximally into more healthy bowel before removing it through a longitudinal incision which is closed transversely. Resection or exteriorization are rarely necessary unless the bowel wall is gangrenous. Very infrequently the stone can be advanced from the ileum into the colon to pass in the stool, but this was not possible in our three cases of ileal obstruction. No attempt should be made to crush an impacting stone within the bowel lumen.[21] The possibility of multiple large stones must always be kept in mind, and a quick survey of the bowel is in order to exclude a second obstructing stone.[11,13]

In these patients the intestinal content is always highly septic and this with the usual obesity makes a wound infection almost inevitable in spite of meticulous operative technic. Wangensteen has stressed the importance of exact surgical technic in the management of these problems.[32] We have routinely lavaged all such wounds with copious amounts of saline before closure and placed drains down to the fascia. It is our experience, however, that these precautions together with the routine use of antibiotics following surgery have been followed with a colon infection in every wound none of which, however, proved serious.

Intragastric gallstones require special consideration. In these patients the obstruction is almost always intermittent and is often relieved by the patient's assuming a position on the left side. In the absence of hemorrhage from the fistulous tract removal of the calculus would seem all that is required. A major gastric hemorrhage occurred in our patient prior to surgery and gastric resection was deemed advisable.

Obstruction of the large bowel by gallstones is relatively infrequent since the majority of stones reaching the colon pass spontaneously. When obstruction does occur, as in Case iv, it is invariably in the narrowed descending or sigmoid colon.

The mortality from intestinal obstruction due to gallstones is exceptionally high. (Table III.) Advanced age, obesity and frequent late diagnosis with too extensive surgical procedures are the responsible factors. The dramatic improvement in the management of acute intestinal obstruction during the past ten years together with an appreciation of the peculiarities of the type of obstruction should result in a progressive lowering of the mortality.

TABLE III
MORTALITY FROM INTESTINAL OBSTRUCTION DUE TO GALLSTONES

Author	Year	Cases	Mortality (Per cent)
Courvoisier[8]	1890	125	44
Schüller[29]	1891	82	56
Lobstein[17]	1895	31	61
Eve[9]	1895	15	40
Hutchinson[14]	1895	...	75
Barnard[3]	1902	14	61
Martin[18]	1912	3	0
Abbott and Hunt[1]	1923	4	50
Moore[21]	1925	4	75
Vick[31]	1932	47	70
Wakeley and Willway[34]	1935	11	27
Balch[2]	1938	7	57
Massachusetts General Hospital service cases	1938	10	70
McQueeney[23]	1939	149	50
McLaughlin and Raines	1949	5	0

CASE REPORTS

CASE I. Mrs. T. H., a white female eighty-one years of age, was admitted to the hospital on October 20, 1940, complaining of crampy abdominal pain, nausea and vomiting for three days.

Three years before the patient had experienced a similar attack of severe nature which subsided rather suddenly, with complete relief of pain. Six months before admission she again had what was considered to be an acute attack of cholecystitis. The patient had a high fever and marked right upper quadrant rigidity, and a mass developed in the right upper quadrant. Plans were made for her hospital admission when she suddenly obtained relief and made an uneventful recovery. Three days prior to the present admission crampy generalized pain developed which was colicky in nature. Nausea and vomiting were present and the vomitus became progressively more foul.

Physical examination on admission disclosed a moderately obese, elderly woman with a distended abdomen and generalized tenderness, most marked in the right upper quadrant. Peristalsis was definitely hyperactive. There were no previous abdominal scars and no hernia. The white blood count was 15,000 and urinalysis negative. A flat abdominal plate showed markedly distended loops of small bowel, the colon being empty, but no shadows were visible. A preoperative diagnosis of small bowel obstruction was made and surgery undertaken.

At operation a large solitary gallstone 3.5 cm. in diameter was found lodged in the terminal ileum 6 inches above the ileocecal valve. The small bowel was dilated above this point and collapsed below. Efforts to pass the stone on into the colon were unsuccessful, so it was moved upward and removed through a longitudinal incision with subsequent closure in a transverse direction. Palpation of the right upper quadrant disclosed the great omentum to be firmly adherent over the entire gallbladder area.

Convalescence was quite satisfactory and except for a superficial wound infection the patient made an uneventful recovery.

CASE II. A. F., a white female sixty-seven years of age, was admitted to the hospital on July 24, 1946, with a thirty-six-hour history of generalized crampy abdominal pain, persistent nausea and vomiting.

For fifteen years the patient had experienced repeated attacks of cholecystitis and in one or two of these attacks jaundice had been a feature. The present attack was characterized by persistent nausea and vomiting. Pain of an intermittent crampy character was present but was not severe.

The abdomen was moderately distended and there was slight diffuse abdominal tenderness without localization. Peristalsis was definitely hyperactive. The patient's temperature was 98°F., pulse 90, white blood count 7,000, and the urinalysis negative. A flat abdominal plate disclosed very marked gaseous distention of the jejunum and ileum. Although a gallstone was suspected as the cause of the obstruction, no definite opacity could be identified on the film. A barium enema was

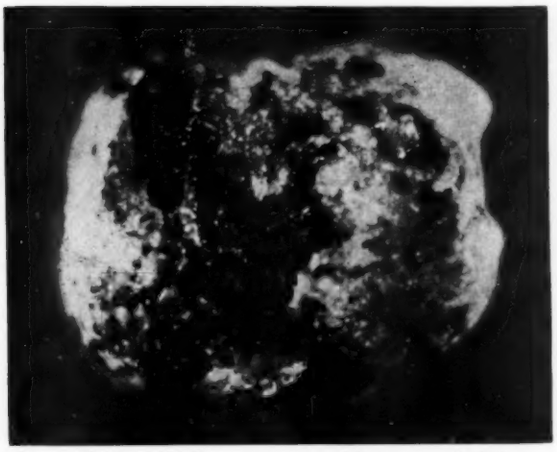


FIG. 1. Case II. Gallstone removed from terminal ileum of patient.

negative. A Miller-Abbott tube was passed and during a twelve-hour period of intestinal decompression the patient received a transfusion of whole blood and the fluid balance was re-established.

At operation a hard gallstone 3 by 2 cm. in diameter was found lodged in the terminal ileum 3 feet above the ileocecal valve. The ileum was collapsed below this point but was still markedly distended proximal to the obstructed site. The stone could not be advanced; it was therefore moved upward and removed through a longitudinal incision which was subsequently closed in a transverse direction. The gallbladder area could not be adequately visualized because of the dilated loops of bowel.

Convalescence was complicated by lobular atelectasis and a superficial wound infection, but the patient made a satisfactory recovery and was dismissed on her twentieth postoperative day.

Subsequent interrogation of the patient disclosed that a twin sister had had an identical attack of acute intestinal obstruction four years previously and had recovered spontaneously after passing a large gallstone per bowel. (Fig. 1.)

CASE III. A. L., a white female sixty-five years of age, was admitted to the hospital on August 13, 1948, in the seventh day of an acute abdominal illness.

For many years she had suffered with cholecystitis, having frequent acute attacks but never being jaundiced. Seven days before admission crampy generalized abdominal pain

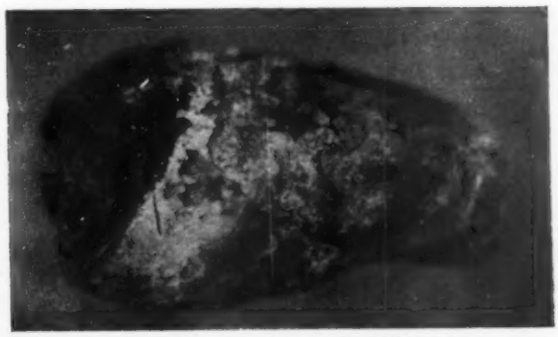


FIG. 2. Case III. Large elongated gallstone removed from terminal ileum.

developed of only moderate severity. This persisted for four days but was not accompanied with nausea or vomiting. Three days prior to admission the pain ceased abruptly but nausea and persistent vomiting became features and continued until admission. There had been two normal bowel movements during the preceding three days. Just before admission the patient vomited a facetted gallstone .5 cm. in diameter which suggested the cause of the obvious obstruction.

Examination on admission disclosed an obese woman markedly dehydrated with moderate abdominal distention. There was only slight generalized abdominal soreness and no muscle guard. Peristalsis was hyperactive. The patient's temperature was 99°F., pulse 100, white blood count 15,000, red blood count 6,200,000, and the urine showed albumin 3 plus with many pus cells. A flat abdominal plate disclosed dilated, fluid-filled loops of small bowel through the central portion of the abdomen. Definite fluid levels were visible. Calcification was seen in the region of the celiac axis but no definite opaque calculus was visible. Decompression was immediately undertaken with a Cantor tube and after suitable preparation the patient was explored.

At operation a firm gallstone approximately 3.5 by 3 by 3 cm. was found firmly impacted in the ileum 2 feet above the ileocecal valve. The bowel was moderately dilated above this site and collapsed below. It was impossible to advance the stone so it was moved upward and removed through a longitudinal incision. The rent in the bowel was closed in a transverse direction and covered with a free omental graft. Palpation of the right upper quadrant disclosed many adhesions in this region but the gallbladder could not be felt or visualized. (Fig. 2.)

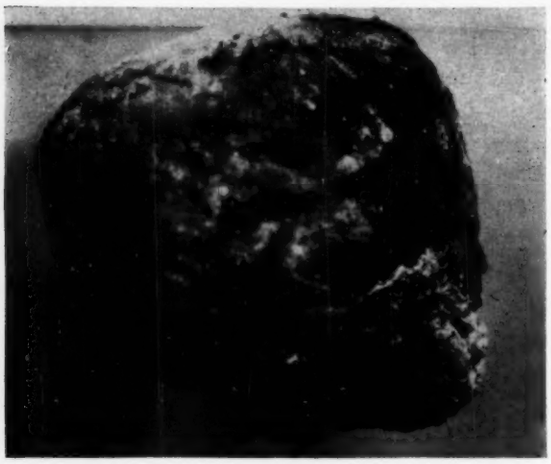


FIG. 3. Case IV. Obstructing gallstone impacted in sigmoid colon of patient; this stone was first lodged in the lower ileum and passed into the colon following small bowel decompression to produce obstruction in the sigmoid again.

Convalescence was complicated by right basal atelectasis and a superficial wound infection. The patient, however, made a satisfactory recovery and was dismissed from the hospital on the thirteenth postoperative day.

CASE IV. T. H., a white male seventy-three years of age, was admitted to the hospital on March 8, 1949, acutely ill with a three-day history of crampy abdominal pain, distention and constipation.

Two years prior to admission the patient had a similar attack simulating acute intestinal obstruction which subsided spontaneously. There was no previous history of colic, but gas and indigestion had been features for years. Three days before admission intermittent crampy abdominal pain, nausea, vomiting and distention developed. These features continued and preliminary examination disclosed a very ill elderly man with a temperature of 100°F., pulse 110 and respirations 26. Hiccough was a feature and the patient was intermittently irrational. The abdomen was grossly distended but not tender. Peristalsis was hyperactive. Rectal examination was negative. A flat abdominal plate showed marked distention of small bowel loops with almost no gas in the colon. Intubation was accomplished with some difficulty and the marked degree of distention overcome. However, signs of acute cardiac failure appeared requiring oxygen and digitalis.

Six days after admission the abdomen was well decompressed and the cardiac status stabilized. A flat abdominal plate showed the small bowel well decompressed but much gas in the colon. Barium enema repeated on successive days showed an obstruction in the mid-sigmoid colon, considered not to be typical of carcinoma.

The colon was prepared by introducing streptomycin through the Cantor tube prior to surgery. Exploration was undertaken under spinal cyclopropane anesthesia March 16, 1949.

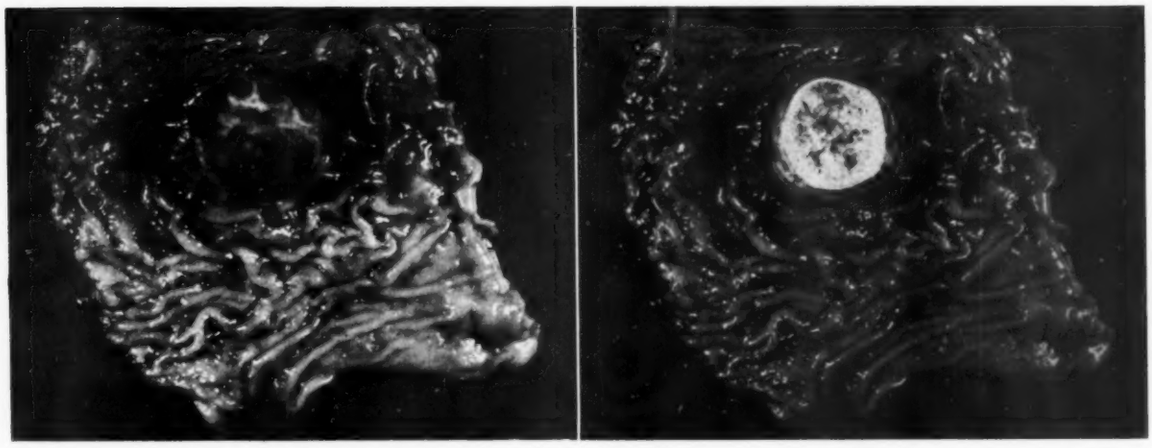
At operation a large ovoid gallstone 3½ by 2½ by 2½ cm. in diameter was found firmly impacted in the sigmoid colon 4 inches above the pelvic brim. The colon proximal to the obstructed site was moderately dilated but the small bowel was well decompressed. A mass of adhesions in the gallbladder area made it impossible to visualize this structure. The stone was removed through a longitudinal incision in one of the colonic bands, closure being in a transverse direction. (Fig. 3.)

Convalescence was stormy, being complicated by basal atelectasis and a superficial wound infection. Both responded to therapy and the patient was dismissed from the hospital on the twenty-first postoperative day with his incision healed.

Comment. In this case the initial obstruction was undoubtedly in the terminal ileum. Following decompression the stone passed through the ileocecal valve and advanced through the colon until it lodged in the sigmoid. Although it might have ultimately passed, colonic obstruction became a feature demanding surgical intervention.

CASE V. G. C., a white male seventy-four years of age, was admitted to the hospital on May 14, 1946, with a three-month history of intermittent pyloric obstruction.

For many years the patient had suffered with recurrent attacks of acute cholecystitis. One year prior to admission he was considered to have developed empyema of the gallbladder but all symptoms suddenly subsided. For three months before admission the patient experienced periodic bouts of epigastric distress associated with persistent vomiting. He had learned that these attacks could usually be terminated by rolling on his left side. All biliary symptoms had subsided since the onset of the intermittent obstructive symptoms. There had been a weight loss of



4 5

FIGS. 4 and 5. Case v. Excised portion of stomach with intragastric gallstone; although this gallstone presents a laminated appearance on section, it was very indistinctly visible on the preoperative x-ray films.

50 pounds in the four-month period prior to admission. Although there was no history of hematemesis or melena, the patient passed a large quantity of dark red blood by bowel soon after hospital admission.

Examination showed an elderly man who was obviously pale and had lost much weight. There was no clinical jaundice. The abdomen was flat and there was no tenderness and no palpable mass. The patient's temperature was normal, pulse 88, red blood count 3,600,000, hemoglobin 71 per cent and white blood count 8,000. Free gastric acid was present, with a total acid of 75 degrees. X-ray examination of the stomach showed this to be of normal size and position with hypoactive peristalsis. There was an irregular constriction involving the distal 5 to 7 cm. of the prepyloric stomach with a filling defect 2 cm. within the duodenal cap, considered to be prolapsing through the pylorus. The duodenal loop was not remarkable. A 30 per cent gastric residual was present after four hours. The x-ray diagnosis was prepyloric carcinoma; the clinical diagnosis was gastric carcinoma with a prolapsing gastric polyp.

After suitable preparation with blood, amigen and vitamin therapy the patient was explored. Preliminary inspection of the abdomen disclosed this to be normal with no obvious carcinoma of the stomach. A hard, rounded mass 3.5 cm. in diameter was palpable in the prepyloric stomach and this could be displaced without difficulty into the fundus. The duodenum was intimately adherent to the gallbladder in an inflammatory mass which did not appear neoplastic. It was considered that a cholecystoduodenal fistula had developed probably at time of last severe attack of cholecystitis one year before with discharge of a large gallstone through the pylorus into the stomach. Partial gastrectomy of the Polya-Balfour type was carried out, removing a large gallstone together with the distal half of the stomach. This procedure was undertaken to divert the food current from the cholecystoduodenal fistula and also because of the massive hemorrhage interpreted to have come from the duodenum.

The excised stomach showed no evidence of carcinoma. An irregular black gallstone 3 cm. in diameter was present within the lumen of the stomach. (Figs. 4 and 5.)

Convalescence was uneventful and the patient left the hospital on the twelfth postoperative day, returning to his work as a night watchman two months later. Follow-up reports indicated that he had no further complaints for a period of twenty-seven months. His family physician then was called following a sudden massive gastrointestinal hemorrhage from which the patient expired at home. No postmortem examination was done.

SUMMARY

1. In a consecutive series of 130 cases of acute intestinal obstruction gallstones were responsible in four cases.

2. During the same period of observation a fifth case with intermittent pyloric obstruction from a large intragastric gallstone was encountered.

3. There is an antecedent history of gallbladder disease in about 50 per cent of the cases.

4. The usual clinical picture is that of an elderly, obese female patient with intermittent partial intestinal obstruction, ultimately becoming complete.

5. A preoperative diagnosis of the type of obstruction is rarely made. The stones are rarely radiopaque and x-ray assists only through demonstrating intestinal obstruction with occasionally the presence of air or barium in the extrahepatic biliary system.

6. The recorded mortality in the group of cases is unduly high, being the result of the age and obesity of the patients, delayed diagnosis and too extensive surgery.

7. In our five reported cases there was no mortality, obstructing stones being successfully removed from the ileum in three instances, the sigmoid in one and the stomach in one.

8. Gallstone obstruction should be suspected in elderly obese patients with a previous history of gallbladder disease who develop a picture of progressive partial intestinal obstruction.

REFERENCES

1. Abbott, C. R. and Hunt, E. L. Intestinal obstruction by gallstones. *Boston M. & S. J.*, 188: 390–397, 1923.
2. Balch, F. G., Jr. Gallstone ileus. *New England J. Med.*, 218: 457–462, 1938.
3. Barnard, H. L. Intestinal obstruction due to gallstones. Report of three cases with summary of five more cases from records of London hospital, 1893–1901. *Ann. Surg.*, 36: 161–182, 1902; Contributions to Abdominal Surgery, pp. 84–115. Edited by James Sherren. London, 1910. E. Arnold.
4. Bennett, C. Obstruction of small intestine by gall stones; 3 cases without mortality. *Brit. M. J.*, 1: 565–566, 1926.
5. Bernhard, F. Die Spontanen Inneren Gallenfistein und Ihre Operative Behandlung. *Deutsche Ztschr. f. Chir.*, 242: 493–506, 1934; Die Fruh- und Spätergebnisse der Cholecystogastrostomie, der Cholecystoduodeno- und Choledochoduodenostomie bei 128 Fallen. *Deutsche Ztschr. f. Chir.*, 242: 736–756, 1934.
6. Beutel, A. Karzinomatose Gallenblasenduodenalfistel. *Röntgenpraxis*, 4: 326–331, 1932.
7. Borman, C. N. and Rigler, L. G. Spontaneous internal biliary fistula and gallstone obstruction with particular reference to roentgenologic diagnosis. Surgery, 1: 349–378, 1937.
8. Courvoisier, L. T. Casuistisch—Statistische Beitrage zur Pathologie und Chirurgie der Gallenwege. Leipsig, 1890. F. C. W. Vogel.
9. Eve, Frederic. Case of acute intestinal obstruction from gallstone; laparotomy; removal of stone; suture; recovery; with a table of previous cases. *Tr. Clin. Soc. London.* 28: 92–99, 1895.
10. Gilman, P. K. Intestinal obstruction from gallstone. *West. J. Surg.*, 40: 594–596, 1932.
11. Hand, B. H. and Gilmore, W. E. Gallstone ileus; recurrence in one case. *Am. J. Surg.*, 59: 72–78, 1943.
12. Hennessy, M. C. Intestinal obstruction due to gallstone. *J. Iowa M. Soc.*, 24: 581–583, 1934.
13. Hinchey, P. R. Recurrent gallstone ileus; report of case. *New England J. Med.*, 223: 174–179, 1940.
14. Hutchinson, Jonathan. Archives of Surgery, vol. 6, pp. 92–94. London, 1895. West, Newman & Co.
15. Kehr. Quoted by Prexot.
16. Leichtenstern. Cited by Barnard, 1910.
17. Lobstein, E. Zur Kasuistik des Gallenstein-ileus. *Beitr. z. klin. Chir.*, 13: 390–426, 1895.
18. Martin, Frank. Intestinal obstruction due to gall stones. *Ann. Surg.*, 55: 725–743, 1912.
19. Mayo, C. W., Miller, J. M. and Stalker, L. K. Acute intestinal obstruction. *Surg., Gynec. & Obst.*, 71: 589–598, 1940.
20. Meyer, K. A. and Spivack, J. L. Intestinal obstruction; analysis of 505 cases from records of Cook County Hospital, Chicago, Illinois. *Ann. Surg.*, 100: 148–157, 1934.
21. Moore, G. A. Gall stone ileus. *Boston M. & S. J.*, 192: 1051–1055, 1925.
22. McNamara, F. P., Faber, L. A. and Nesler, A. B. Acute intestinal obstruction due to impacted gallstone. *J. Iowa M. Soc.*, 26: 45–47, 1936.
23. McQueeney, A. M. Internal biliary fistulae and intestinal obstructions due to gallstones. *Ann. Surg.*, 110: 50–54, 1939.
24. Osler, Sir William. Practice of Medicine, p. 534. New York, 1901. Appleton & Co.
25. Powers, John H. Acute intestinal obstruction due to impacted gall stones; report of 4 cases. *Surg., Gynec. & Obst.*, 47: 416–420, 1928.
26. Prevot, R. Uber Innere Gallenwegfistein. *Röntgenpraxis*, 5: 177–182, 1933.
27. Rigler, L. G., Borman, C. N. and Noble, J. F. Gallstone obstruction: pathogenesis and roentgen manifestations. *J. A. M. A.*, 117: 1753–1759, 1941.
28. Roth, Schroeder and Schloth. Quoted by Beutel.
29. Schüller, Max. Gallensteine als Ursache des Darmobstruktion, p. 63. Strassburg, 1891. Goeller.
30. Souttar, H. S. Discussion. *Brit. M. J.*, 2: 1000–1001, 1925. (From Brit. M. A., Section on Surgery. Proceedings annual meeting, Bath, 1925. Discussion on acute intestinal obstruction. *Brit. M. J.*, 2: 993–1004, 1925.)
31. Vick, R. M. Statistics of acute intestinal obstruction. *Brit. M. J.*, 2: 546–548, 1932.
32. Wangensteen, O. H. New operative techniques in management of bowel obstruction. *Surg., Gynec. & Obst.*, 75: 675–692, 1942.
33. Wakefield, E. G., Vickers, P. M. and Walters, Waltman. Intestinal obstruction caused by gallstones. *Surgery*, 5: 670–673, 1939.
34. Wakeley, C. P. G. and Willway, F. W. Intestinal obstruction by gall stones. *Brit. J. Surg.*, 23: 377–394, 1935.

INTUSSUSCEPTION IN INFANCY AND CHILDHOOD*

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INTUSSUSCEPTION has been a perplexing problem to the physician ever since it was first described by John Hunter in 1789. It is a disease prevailing in infancy insofar as approximately 75 per cent of all cases occur in children under two years of age. It is the most frequent cause of acute intestinal obstruction in the very young.

The purpose of this review is to present all cases seen at The New York Hospital between 1932 and 1949 in the hope that they may shed further light on this obscure subject.

The New York Hospital series consists of thirty-five selected cases from the pavilion service of The New York Hospital from 1932 to 1949 during which time a total of 42,428 operations were performed on patients admitted to the general surgical pavilions. The size of reported series varies greatly between that of Ladd[1] with 372 and that of McLaughlin[6] with twenty. The criteria for the selection of our cases was that intussusception be found at operation.

The ages of our patients lay between three and one-half months and fourteen years. The commonly reported greater incidence in males was not as apparent in this series with eighteen males (51.4 per cent) and seventeen females (48.6 per cent) as in other series (Ladd[1] 61 per cent males, Gibbs[8] 62 per cent males). Twenty-four infants were under one year of age and of these twelve were six months old or less.

Symptoms. Anorexia and refusal of food was common to almost all of the patients. In 91.6 per cent this symptom had been present more than ten hours. Gibbs and Sutton[8] found this symptom in 73.3 per cent of their cases.

Vomiting occurred in twenty-four or 97.1 per cent of the patients and had been present ten or more hours in 79.4 per cent. In Gibbs and Sutton's series vomiting occurred in 89.5 per cent of the cases. Some type of abdominal pain was noted in twenty-four of the thirty-five children.

The fact that 34.2 per cent of the cases had had colds from one to four weeks prior to admission may be of significance but cannot be proven to be in our cases. There was a previous history of bloody stools in twenty-three patients and twelve complained of some change in bowel habit, either constipation or diarrhea, occurring twenty-four or more hours before admission.

TABLE 1
INTUSSUSCEPTIONS FOUND AT OPERATION

Types	No. of Cases	Total (Per cent)
Mixed:		
Double		
Ileo-ileocolic	1	2.8
Ileo-cecal-colic	1	2.8
Multiple		
Ileo-ileo and ileocolic	4	11.5
Total mixed	6	17.1
Ileocolic	6	17.1
Ileocecal	23	65.8
Total Cases	35	100.0

Physical Signs. Most of the patients were well developed and well nourished and most of them exhibited restlessness, occasional pallor, feeble pulse, prostration and flaccidity.

In thirty-one cases (88.5 per cent) an abdominal mass was found. A similar figure is revealed in Ladd's[1] series (84 per cent). The mass was palpated in the upper abdomen in twenty-seven (77.4 per cent), in the left lower quadrant in four (16.1 per cent) and in the right lower quadrant in one (6.5 per cent). Of the total cases eighteen (51.4 per cent) had blood per rectum on digital examination and seven (20 per cent) had a mass felt anteriorly in the rectum. Gibbs[8] noted this finding in 41.2 per cent of his cases.

It is of interest to note that there was injection of the posterior pharynx in seven children and rhinitis in one.

Laboratory Examination. The only conclusive laboratory finding was that twenty-seven

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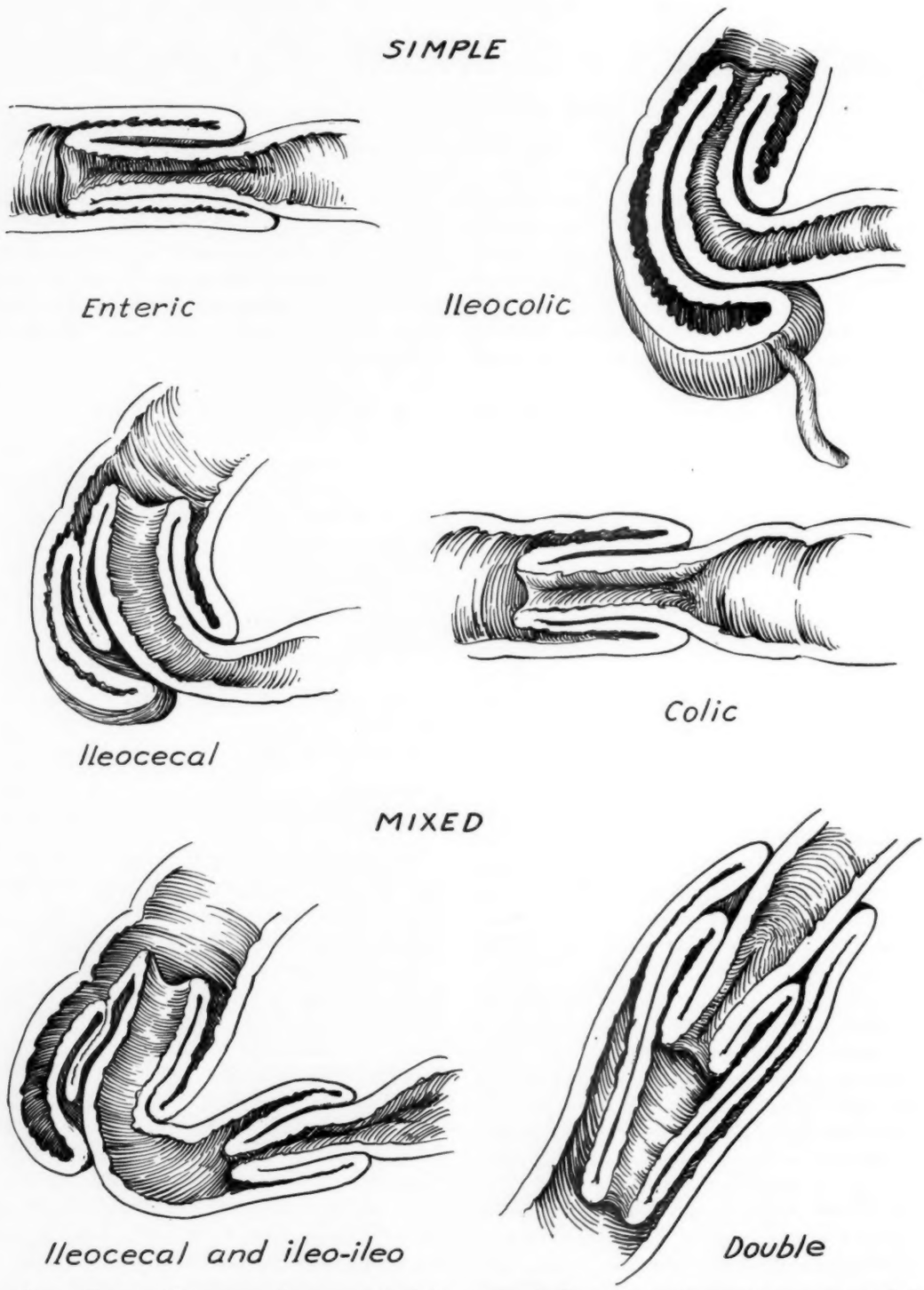

FIG. 1. Types of intussusceptions seen (semi-diagrammatically shown); the enteric type is included even though it is not discussed in this series.

patients (77.1 per cent) had a white blood count of ten or more thousand. A barium enema was not a routine procedure in the work-up; however, when done it was for diagnostic and not therapeutic purposes. Hipsley[3] has had good results with barium enema in treatment of intussusception in Australia. He was able to reduce 60 per cent of his cases by enema alone and in the remaining 40 per cent operated upon, 18 per cent were already reduced.

Findings at Operation. As can be observed in Table 1 the ileocecal type of intussusception was most common. The double and multiple intussusceptions are classified as a mixed group and are shown diagrammatically. (Fig. 1.) Smith[7] reported five cases of multiple intussusception in his series of thirty-five cases.

Etiology. The etiology was not evident in our cases; however, some interesting observations were made at the operating table in regard to cause.

In fifteen, or 42.9 per cent of the cases there were no abnormal findings save the intussusception itself. Large, succulent mesenteric lymph nodes, especially near the ileocecal junction, were present in fourteen (40 per cent) of the thirty-five cases. In one patient a large mesenteric gland was biopsied and a diagnosis of chronic lymphadenitis established. It was not possible to correlate the presence of enlarged mesenteric nodes with upper respiratory infection insofar as the incidence of such enlarged glands was as great in children without colds as in those with a history of upper respiratory infection. Hogg[2] was unable to identify an etiologic factor in 83 per cent of his cases but found large lymph nodes in 11 per cent.

A Meckel's diverticulum was found at the head or the beginning of the intussusception in two (5.7 per cent) cases. In one of these the diverticulum was reddened and swollen and in the other there was evidence of inflammation of the surrounding area. Both cases had successful resection of Meckel's diverticulum. Hahle[9] found two diverticula in eighty-eight cases under two years of age, an incidence of 2.3 per cent.

Congenital bands and folds were present in three (8.5 per cent) cases. In two of these the bands were firm enough to cause kinking of the small bowel adjacent to the cecum. In all cases the bands ran from the distal ileum to the cecum.

A hypertrophied Peyer's patch was found at the head of the intussusception in one case; a local resection was performed and the small bowel anastomosed to the cecum at a point just distal to the ileocecal valve. (Fig. 2.)

Surgical Methods. In thirty-seven or 77.1 per cent of the cases the intussusception could

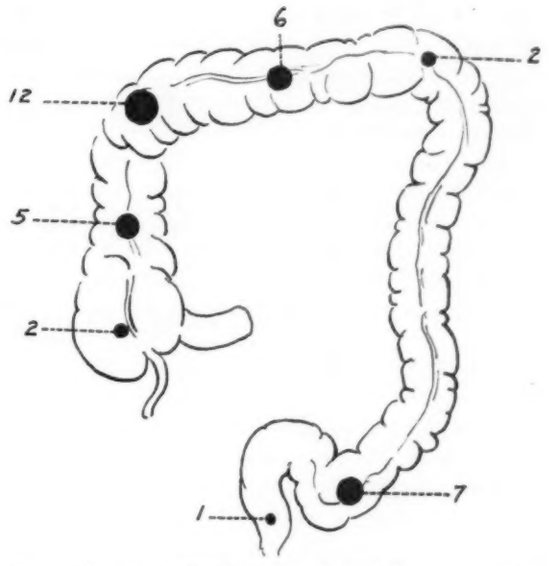

FIG. 2. Points of distal progression of the intussusception into the colon and the number of cases occurring at each site.

be reduced by "milking," a term applied to gentle massage and squeezing of the distal end or head of the intussusception until complete reduction is accomplished. Traction is never exerted on the proximal point. In one case the intussusception had extended as far as the sigmoid colon; by patience and gentle milking it was reduced in twenty minutes. This example illustrates that even the most difficult intussusception can be reduced with sufficient gentleness and with patience. Mayo[5] reduced forty-four of fifty-five (80 per cent) and Gibbs[8] seventy-seven of ninety-two (83.7 per cent) of their cases in this manner.

An intestinal resection of some type was performed in five (14.3 per cent) cases as discussed elsewhere in this article.

In one case a small isolated area of gangrene was present on the wall of the cecum. This was inverted with several interrupted sutures of silk. The patient did well after operation.

A local resection of a Meckel's diverticulum was done in two (5.7 per cent) of the cases.

Open drop ether was used almost exclusively as the anesthetic agent. Postoperatively, the

patients were not given anything by mouth for from one to three days. During this period they were maintained on parenteral fluids consisting mainly of 5 per cent glucose in D/W and the replacement of drainage through intragastric suction by saline. After this initial period they were started on clear fluids and then rapidly advanced to a fuller diet.

Mortality. There were five deaths (14.3 per cent) in the series of thirty-five cases. Three children died following intestinal resections, a 60 per cent mortality, while in the unresected group only two died (mortality 6.7 per cent). The over-all mortality of 14.3 per cent compares favorably to Mayo's[5] which was 23.6 per cent and Ladd's 59 per cent. Hahle's[9] showed a 100 per cent mortality in resected cases. (Table II.)

TABLE II
ANALYSIS OF DEATHS

Age at Death	Duration of Symptoms	Examination	Operation	Course	Autopsy
10 mo.	32 hr.	a) Abdominal mass in left lower quadrant b) Mass per rectum c) Semicomatose on admission	a) Extensive intussusception b) Resection 12 cm. of bowel with primary anastomosis	Downhill death 6 da. postoperatively	a) Fibrinopurulent peritonitis b) Bronchopneumonia
7 mo.	18 hr.	a) Abdominal mass b) Distention c) Blood per rectum	a) Intussusception reduced by milking b) At closure bowel looked blue but viable	Downhill death 18 hr. postoperatively	None
4 mo.	40 hr.	a) Distention	a) Ileo-ileocecal b) Viable bowel, easily reduced	Remained distended death 3 da. postoperatively	a) Cloudy yellow fluid b) No evidence of perforation
3½ mo.	96 hr.	a) Semicomatose b) Distention c) Rigid abdomen	a) Dark brown fluid b) Intussusception to sigmoid and volvulus c) Ileo-ileo gangrene with leakage d) Resection with primary anastomosis	Downhill death 7 hr. postoperatively	a) Fibrinopurulent peritonitis b) Bronchopneumonia
7 yr.	2 mo. and 3 mo	a) Abdominal mass b) Abdominal spasm and tenderness	a) Large loop of gangrenous small bowel b) Resection with primary anastomosis	Distention with spasm in left lower quadrant; incision and drainage of abscess; death 6 da. postoperatively	a) Fibrinopurulent peritonitis b) Pleuritis

COMMENTS

It is very evident that the duration of symptoms before operation is still far too long. The necessity of early diagnosis cannot be over emphasized. It is as important in intussusception as it is in acute appendicitis for both conditions are adversely affected by delay. Four of the five patients coming to autopsy had had one or more of their symptoms for more than twenty-four hours and the fifth for eighteen hours before admission. The observation is of interest that the majority of these late cases were referred to the hospital by the family physician who often had seen the child first many hours prior to admission and in several he had failed to make the correct diagnosis until his second or third visit to the patient. This would seem to indicate that it is not only the general public which needs to be informed about the condition but that the medical profession also must be educated to recognize it and become more astute in making the diagnosis. In no other way can the mortality be lowered. An analysis of Table II confirms the significance of a long duration of symptoms on the final result of treatment. Four of the five patients who came to autopsy might have been saved if they had been treated earlier.

As stated earlier, five of the thirty-five patients had some type of intestinal resection of which three were primary resections with end-to-end anastomoses. The following basic steps were undertaken: the gangrenous segment of bowel was removed between Kocher clamps, the mesentery divided between clamps and the anastomosis accomplished with interrupted fine silk sutures in layer closure over the Kocher clamps. The suture line was further inforced with interrupted arterial silk sutures and the defect in the mesentery repaired with interrupted fine silk sutures.

In one case the primary resection was combined with an end-to-side anastomosis, the same technic as before being used.

The fifth case had a resection of the gangrenous segment of bowel with the proximal loop of the small intestine anchored to the anterior abdominal wall.

The prognosis as to the result of treatment can be determined with considerable certainty on the basis of the duration of symptoms before operation. A further analysis of the five children who died reveals some observations which may be of significance. Three of the five deaths were in patients whose intussusception extended to the hepatic flexure; in the fifth the intussusception was in the ascending colon. One death occurred in a primary resection; however, it is probably not alone attributable to the operative procedure but rather to the aspiration of gastric contents in the operating room. In spite of immediate aspiration of the tracheobronchial tree, bronchopneumonia developed; however, peritonitis was also present at autopsy.

Of the remaining four fatalities, three came to autopsy. Fibrinopurulent peritonitis was given as the cause of death in all three. There was in no case evidence of leakage at the site of the anastomosis nor of perforations elsewhere.

In no case did evidence develop of an acute surgical abdomen postoperatively except one. On the sixth day after operation this child complained of tenderness and spasm in the left lower quadrant. An incision was made and approximately 10 cc. of pus evacuated.

Only two cases became distended following operation.

SUMMARY

A detailed analysis is given of thirty-five patients from The New York Hospital pavilion service who were treated for intussusception in seventeen years from 1932 to 1949. The deaths are recorded in table form.

The fact that in the majority of cases symptoms occurred ten or more hours before the patient was admitted to the hospital proves that neither the general public nor the general practitioner are making the diagnosis early enough to assure a successful operation. The mortality can hardly be lowered without earlier diagnosis and admission to a surgical service.

A number of patients had a history of recent respiratory infections (34.2 per cent) or injection of the posterior pharynx on their admission examination. Mesenteric nodes were found to be enlarged at operation in 40 per cent of the cases. However, no definite relationship between these findings could be established.

The large majority of cases (thirty) were successfully treated with "milking." In one case it required twenty minutes to reduce the intussusception by this means. Patience and gentle handling of the bowel are essential if this method is to be successful.

The New York Hospital series differs in no way from other reports in that the mortality after resection was very high. Only by avoiding the necessity of resection by early diagnosis and prompt operation can this high mortality rate be lowered. As long as the intussusception can be reduced by milking, the death rate can be kept down to around 6.7 per cent.

REFERENCES

1. Ladd, W. E. and Gross, R. E. Intussusception in infancy. *Arch. Surg.*, 29: 365, 1934.
2. Hogg, B. M. Intussusception in infancy and childhood. *Ann. Surg.*, 124: 262, 1947.
3. Hipsley, C. Treatment of intussusception. *Surgery*, 1: 285, 1937.
4. Magney, F. H. Acute intussusception in infancy and childhood; 58 cases. *Minnesota Med.*, 30: 257, 1947.
5. Mayo, C. and Woodruff, R. Acute intussusception. *Arch. Surg.*, 43: 583, 1941.
6. McLaughlin, C. W. Surgical management of irreducible intussusception. *Arch. Surg.*, 56: 48, 1948.
7. Smith, O. Intussusception: diagnosis and treatment. *Am. J. Surg.*, 70: 158, 1945.
8. Gibbs, E. and Sutton, P. Intussusception; 92 cases in infancy. *Surgery*, 14: 708, 1943.
9. Hahle, H. Analysis of 150 cases of intussusception. *Am. J. Surg.*, 52: 215, 1941.

RIGHT INGUINAL HERNIA FOLLOWING APPENDECTOMY*

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RIGHT inguinal hernia developing after appendectomy has been observed frequently. A review of a series of 576 patients with inguinal hernia sixty-seven of whom had undergone appendectomy previously showed that the incidence of right inguinal hernia following appendectomy was twice as frequent as in the remainder of the series. (Table 1.)

TABLE 1

	INGUINAL HERNIA PRECEDED WITH APPENDECTOMY (67)			INGUINAL HERNIA NOT PRECEDED WITH APPENDECTOMY (509)		
Side	Right	Bi-lateral	Left	Right	Bi-lateral	Left
Total.....	40	12	15	202	153	154
Per cent..	59.7	17.9	22.4	39.7	30.1	30.2
	Ratio R:L—2.67:1			Ratio R:L—1.31:1		

The development of an inguinal hernia following appendectomy varies with the individual case, but all of the causes may be grouped according to the gross anatomic structures injured or destroyed during or following appendectomy. The indirect inguinal hernia with its congenital sac, the unobliterated processus vaginalis, makes its exit from the abdomen through the internal abdominal ring in company with the cord structures in the male and the round ligament in the female. In many instances a snug-fitting internal abdominal ring which permits the spermatic cord or round ligament with a congenital sac to emerge from the abdomen is sufficient to prevent contents of the peritoneal cavity from entering the sac. However, when this ring is enlarged either by accidental trauma, incision or by tearing due to increased intra-abdominal pressure, the sac fills with its contents and the hernia becomes obvious. The triangle of Hesselbach in the plane of the transversalis fascia is the weakest portion of the anterior abdominal wall. The transversalis fascia confines the abdominal contents and when damaged predisposes to the development of the direct inguinal hernia. Since appendectomy is one of the most common operative procedures done in the right lower quadrant of the abdomen, it is not surprising that the incidence of right inguinal hernia is greater in those who have had appendectomy done through an incision on the right side.

There are other causes for the development of an inguinal hernia following appendectomy. The sloughing of transversalis fascia due to infection may result in the bulge of the direct inguinal hernia, predispose to an indirect inguinal hernia or permit the bulge of an incisional hernia. Damage to the internal oblique muscle removes the shutter mechanism which aids in maintaining the integrity of the inguinal region. Injury to the nerve supply to this muscle results in muscle atrophy and is thus a cause for protrusion in the inguinal region.

In the series of sixty-seven patients who had a scar from appendectomy and who were subsequently operated upon for inguinal hernia forty had right inguinal hernias (59.6 per cent), fifteen had left inguinal hernias (22.4 per cent) and twelve had bilateral inguinal hernias (17.9 per cent). Thus in the sixty-seven patients who had undergone appendectomy fifty-two had right inguinal hernias. The ratio of the incidence of right inguinal hernia to left inguinal hernia in this group (40 to 15) is 2.67 to 1.

In the 509 patients with inguinal hernia in whom no incision for appendectomy was present there were 202 on the right side (39.7 per cent), 154 on the left side (30.2 per cent) and 153 bilateral (30.1 per cent). The ratio between the incidence of right and left inguinal hernia in this series (202:154) is 1.31 to 1. Comparing the two groups the incidence of right inguinal hernia is approximately twice as common following appendectomy. In those operated upon for bilateral hernia there is some doubt

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as to the actual existence of hernias on both sides. The 30 per cent rate for bilateral herniotomy would indicate that in some a slight or minor defect was present. This is difficult to evaluate in the absence of detailed records of the operative findings.

peritoneum. The integrity of the triangle of Hesselbach and the internal abdominal ring must be preserved.

If one could avoid injury to the important structures in the inguinal region below the level of the anterosuperior spine of the ilium extend-

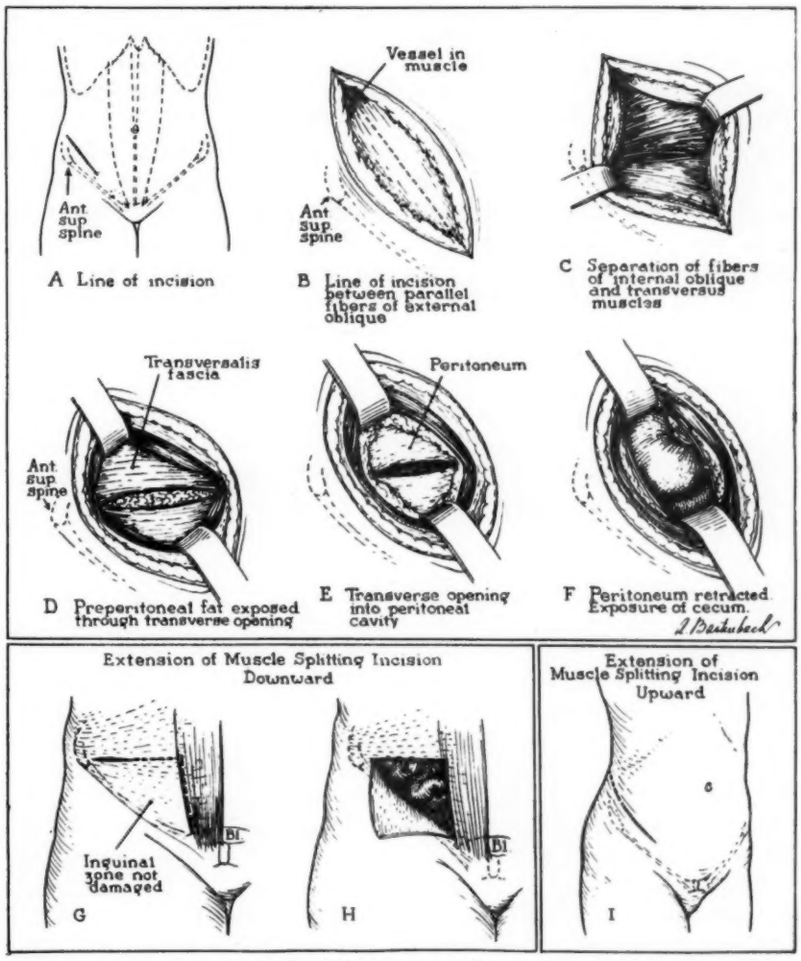
Ant sup spine
A Line of incision
Vessel in muscle
Ant sup spine
B Line of incision between parallel fibers of external oblique
C Separation of fibers of internal oblique and transversus muscles
Transversalis fascia
Ant sup spine
D Preperitoneal fat exposed through transverse opening
Peritoneum
E Transverse opening into peritoneal cavity
F Peritoneum retracted Exposure of cecum.
Extension of Muscle Splitting Incision Downward
Inguinal zone not damaged
G
H
Extension of Muscle Splitting Incision Upward
I

FIG. 1. A to F, exposure of the right lower quadrant of the abdomen for appendectomy without injury to the internal abdominal ring and triangle of Hesselbach; G to H, methods for enlarging the muscle-splitting incision without injury to the inguinal region.

The significance of this study is that it points out the need for preserving intact the structures of the abdominal wall in the right lower quadrant of the abdomen during the muscle-splitting incision and the right rectus incision.

Nerves and muscles should be protected from injury during surgery. The transversalis fascia is a most important structure. When incised it should be sutured or at least allowed to heal without hindrance from protrusion of fat or

ing from this spine to the rectus muscle, the possibility of herniation would be markedly reduced. The muscle-splitting incision is illustrated to indicate a method for avoiding injury to the transversalis fascia in the inguinal region. (Fig. 1.)

The skin incision is not of importance in hernia formation. It should expose the deep layers of the abdominal wall at the site to be utilized for the approach to the appendix. In

the muscle-splitting incision the external oblique aponeurosis is exposed and opened between parallel fibers. A transverse incision between fibers of the internal oblique muscle at the level of the anterosuperior spine of the ilium exposes the parallel fibers of the transversus muscle which are also separated. A transverse incision through the transversalis fascia at the same level will avoid injury to the internal ring and triangle of Hesselbach. If more extensive exposure is found to be necessary, incision of the fascia to the rectus muscle and thence down to the pubic spine if necessary may be done. Such exposure of the right lower quadrant of the abdomen is associated with the least damage to the inguinal region. In the right rectus incision a careful closure of the posterior sheath of the rectus muscle and transversalis fascia over the full extent of its incised wound will prevent the weakness in the fascia responsible for hernia formation.

SUMMARY

The incidence of right inguinal hernia in patients who had previously undergone appendectomy appears to be twice as frequent as in those who have not had an opening made into the abdomen in the right lower quadrant. The cause of this greater frequency is most likely an injury to or destruction of the transversalis fascia. Injury to nerves and muscles may predispose to a defect favoring development of an inguinal hernia. A method of exposure of the right lower quadrant of the abdomen which avoids injury to the internal abdominal ring and the triangle of Hesselbach is illustrated to point out the zone that must be preserved.

Obstetric Clinic

THE woman about to become a mother or with a new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden, or stretches her aching limbs. The very outcast of the streets has pity upon her sister in degradation, when the seal of promised maternity is impressed upon her. The remorseless vengeance of the law brought down upon its victims by a machinery as sure as destiny, is arrested in its fall at a word which reveals her transient claim for mercy. The solemn prayer of the liturgy singles out her sorrows from the multiplied trials of life, to plead for her in her hour of peril. God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, unadvisedly or selfishly.

OLIVER WENDELL HOLMES

4th of the Series

PLACENTA PREVIA*

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DEFINITE advances in the diagnosis and management of placenta previa have occurred within the past decade. Discard of formerly used methods of therapy has simplified the modern treatment of this obstetric complication. Clinical experience has shown a high degree of safety in expectant management with worth while increase in fetal salvage. The great need for large amounts of compatible blood is more apparent than ever.

* * * *

CASE 1. A thirty-two year old white female, para III, had suffered a badly lacerated cervix as a result of previous deliveries. Five weeks prior to term a vaginal hemorrhage occurred at home. Upon admission to the hospital x-ray examination failed to disclose evidence of placenta previa, so the patient was discharged after three days. Five weeks later the membranes ruptured spontaneously. On the following day after the onset of labor pains excessive vaginal bleeding recurred. The ambulance surgeon who attended the patient estimated that 500 cc. of blood had been lost.

On admission to the hospital the blood pressure was 80/50, pulse rate 100 and hemoglobin 75 per cent. The fetus was in vertex presentation and the fetal heart was heard. Weak uterine contractions had been present for four hours. Vaginal examination showed the cervix dilated to 3 cm. and a partial previa. Braxton Hicks' version was performed, a 1-pound weight attached to the protruding foot and spontaneous delivery awaited. After an intravenous administration of glucose solution was finished, the blood pressures ranged from 140 to 160 systolic. Labor progressed satisfactorily and the patient was in good condition three hours after admission. Ten minutes later she went into shock. She was pulseless, with blood pressure 64/50. Intravenous administration of hypertonic glucose was begun and a blood transfusion followed. At the completion of the transfusion the fetus had been delivered spontaneously to the umbilicus. Without taking the patient

* Cases are from the Committee on Maternal Welfare of the Medical Society of the County of Kings, Brooklyn, N. Y. The views expressed are those of the authors.

out of shock position delivery was completed. The cervix was said to be completely dilated. The fundus rose to the umbilicus just before delivery of the head. The stillborn fetus weighed 3,100 gm. A large, soft tumor mass was felt to the right of the uterus. After expression of the placenta vaginal examination revealed a large rent in the right lateral wall of the uterus. Hysterectomy was performed and a tear about 10 cm. long was noted in the right lateral wall of the uterus extending through the cervix. During the operation the patient was pulseless except for an interval near the completion of the procedure. A total of 2,500 cc. of blood had been given. The patient died on the operating table as the operation was being completed.

Questions. (1) Can a diagnosis of placenta previa be made on the history alone, by x-ray examination alone or by a combination of these two alone? Will rectal examination aid? (2) Does the onset of labor initiate or aggravate hemorrhage? Who is likely to suffer the more profuse hemorrhage, the primipara or multipara? Why is previa more common in the multipara. (3) What place has Braxton Hicks' version in the treatment? Was it the proper procedure, and if not, what should have been done for this patient? (4) Was blood transfusion given early? (5) Should this patient have been permitted to go home after her first hospital admission without ascertaining the cause for her hemorrhage?

Answers. A history of painless, apparently causeless hemorrhage in the third trimester of pregnancy should make a presumptive diagnosis of previa. Abdominal examination may be significant. The presenting part is unengaged because of the presence of the placenta in the lower segment and there is an increased frequency of abnormal presentation. The incidence of transverse presentation is so high as to lead one to suspect previa when this malpresentation occurs. A placental bruit is difficult to recognize and is unreliable; the placenta may be implanted posteriorly. X-ray examination employing either the cystogram or the soft tissue technic is often used but an absolute diagnosis cannot be made without vaginal examination. With the exception of massive hemorrhage or fetal distress few would subject a patient to cesarean section without such confirmatory evidence.

Rectal examination in patients with painless bleeding is definitely contraindicated. It may initiate or aggravate bleeding and can do little more than determine that the presenting part is in the pelvis, information which as a rule can be acquired by abdominal examination. It also carries risk of infection, for the examining finger transports bacteria from the lower vagina where they are more numerous to the area of placental separation. The clotted blood then affords excellent culture media for their propagation. If, however, labor is active, the presenting part deep in the pelvis and the bleeding not massive, rectal examination may be done and may disclose an effaced cervix closely applied to the vertex. The palpation of sutures and fontanels rules out placenta previa. The progressive dilatation of the cervix may then be followed with rectal examination. Premature labor is occasionally accompanied with vaginal bleeding considerably greater than the "show" and without any apparent cause such as placenta previa, placenta ablatio or cervical lesions.

It must not be forgotten, however, that the onset of labor may initiate or aggravate hemorrhage in patients with previa. Hemorrhage occurs from the area of separated placenta in the region of the cervix, and the taking up and dilatation of the cervix during the first stage of labor may cause separation or widen its area. Multiparas are more prone to profuse hemorrhage than primiparas. It may be that the explanation lies also in this direction, possibly due to greater taking up of the cervix in formation of the lower uterine segment. The incidence of previa increases with multiparity and any cause for atrophic endometrium. Decreased vascularity tends to favor spread of placental formation over a wider area; this is substantiated clinically by the wider and thinner placentas seen in previa.

Braxton Hicks' version is obsolete. Not only is the fetal mortality associated with this procedure very high but also the maternal mortality is increased. Technically this is an extremely difficult procedure, especially if the fetus is not small. The two fingers of the operator that are inserted through the cervix have difficulty in locating, recognizing and grasping a foot, only to find, then, that it cannot be pulled through the cervix without added manipulations. The increased vascularity of the cervix and lower segment in previa makes for a sponge-like tissue that is occasionally so friable

that it may be torn with the ease of moist blotting paper; thus rupture of the uterus may result as shown here. In the occasional instance of association of a footling or complete breech in a multipara with low implantation of the placenta (defined later as including the marginal type) and a non-viable or dead fetus, pulling down a foot may be feasible. This procedure is justified only if it can be accomplished easily through an already sufficiently dilated cervix. It must never be followed with extraction. This particular patient was further predisposed to rupture of the uterus in that she had a dry uterus and extensive old cervical lacerations, one of which may have given way. The treatment should have been immediate transfusion and cesarean section.

Blood transfusion was not given early enough in this case. *The need for blood in this and other serious complications of pregnancy and labor is so great that no patient should be delivered in an institution where large amounts of compatible blood are not immediately available.* A patient who is suspected of previa should be typed for the Rh factor and blood grouping on admission to the hospital and at least 1,000 cc. of compatible blood kept near her until the pregnancy is terminated and danger of hemorrhage past. Plasma is a poor stopgap, ineffective if hemorrhage has been profuse and dangerous if it is pooled. Since plasma has no oxygen-carrying power but aids only in maintaining the blood pressure, the patient eventually becomes anoxic and irreversible shock occurs. *Blood given after irreversible shock has occurred is worthless.* Intravenous crystalloids should be used only during the time necessary to obtain blood, for their effect is temporary. When used in large amounts they are actually harmful.

* * * *

Case II. A thirty year old white female, para IV, during a severe coughing spell in her thirty-sixth week of pregnancy had a vaginal hemorrhage amounting to a few ounces. This was followed with intermittent spotting. On abdominal examination the vertex was found in the right iliac fossa and the fetal heart was heard. On vaginal examination the cervix was found well formed, admitting one finger easily, and the edge of the placenta was identified close to the internal os. The membranes were ruptured artificially following which the head dropped into the pelvis. An abdominal binder with lateral pads was then applied so as to fix the fetus in position. Hemostasis appeared satisfactory for twenty-six hours when hemorrhage recurred. There was no labor. The patient was then transfused with 500 cc. of blood, taken to the delivery room and a Voorhees bag introduced. Bleeding was controlled and within two hours irregular contractions occurred. Eight hours after introduction of the bag it was expelled and this was followed by spontaneous delivery of a living fetus. All attempts at Credé's expression failed. Three operators attempted the expression. After forty minutes the placenta was manually extracted. Postpartum hemorrhage could not be controlled by massage and oxytocics, and the patient died three hours after delivery of the placenta.

Case III. A thirty-nine year old female, gravida VIII, para VII, pregnant eight months, suffered a sudden profuse vaginal hemorrhage at home estimated as between 1 and 2 quarts of blood. When admitted to the hospital she was in moderate shock. On vaginal examination the edge of the placenta was felt just through a cervix that was dilated 4 cm. Morphine, intravenous glucose solution and a transfusion of 500 cc. of blood were given just prior to the examination. The membranes were ruptured artificially and this controlled the bleeding.

Spontaneous delivery of a stillborn fetus followed within a few hours. About one-half hour after delivery of the placenta the patient received a transfusion of 750 cc. of blood. Her condition was described as good. The uterus suddenly relaxed one-half later and profuse hemorrhage recurred. The uterus and vagina were packed but the patient continued to bleed through the pack and died within the hour just as another transfusion was begun.

Questions. (1) Is Case II one of placenta previa? (2) In Case II was the introduction of the bag proper therapy after recurrence of the hemorrhage? (3) Is the third stage of labor any different in previa? Should postpartum hemorrhage be feared? (4) What role did the uterine pack play in the death of the patient in Case III? (5) How good is an abdominal binder? How good are the lateral pads used to fix the fetus in position?

Answers. Case II is a case of placenta previa. Certain authors of modern texts have now agreed that since the degree of encroachment of the placenta on the internal os may

change with labor, the diagnosis of the type should be made at the time of the first vaginal examination. Case II formerly would have been classified as marginal placenta previa. It has been further agreed that the term "marginal" should be discarded and all such cases included in the group called low implantation of the placenta. If the internal os is covered partially by placenta, the term "partial" is used; if completely, "total." The name "central," previously used synonymously with total, is not advisable since it implies a symmetric implantation of the placenta over the internal os of the cervix, and this usually is not the case. We will follow this new nomenclature.

We have given up use of the Voorhees bag in the treatment of placenta previa. Patients so managed generally need further therapy when cervical dilatation permits the bag to fall out, and are at this time not good candidates for further treatment. Manipulations incidental to introduction of the bag traumatize the highly vascular lower segment and profuse bleeding may occur. When the bag falls out or if the pains lag, the operator may be tempted to perform internal version and extract the fetus; this is particularly hazardous. The bag also tends to cause malpresentation by displacing the presenting part and occasionally may have to be replaced because of leaking. Infection may result from its use.

When rupture of the membranes is employed in the treatment of low implantation of the placenta and hemorrhage recurs, simple traction on the scalp by means of Willett's forceps is advocated by some. We have had but little experience with its use. A 1-pound weight attached to the forceps should be hung over the edge of the bed. This slight traction is generally enough to cause hemostasis; a heavier weight should not be used. Even a 1-pound weight may produce slight scalp wounds. When possible the clamp should be applied close to the occiput to maintain flexion of the fetal head. It may be removed when the scalp is seen through the distended vulva.

If rupture of the membranes is elected as treatment for placenta previa, particular attention must be paid to the degree of previa as well as the condition of the cervix. The cervix must be sufficiently dilated and the degree of encroachment of the placenta on the internal os little enough to permit the vertex to come down against the placental edge for hemostasis. Rupture of the membranes has its greatest value when labor has been established, for the vertex can then be more confidently expected to press against the placenta. The condition of the cervix is of greater importance than the degree of previa. Rupture of the membranes should not be elected in the primipara before the onset of labor, nor in any case in which a long, uneffaced, undilated cervix is encountered. As indicated elsewhere it is inadvisable if hemorrhage is massive even if the status of the cervix and the degree of previa satisfy the aforementioned conditions. These patients are likely to have marked vascularity of the cervix and lower segment and are best treated with cesarean section. Actually its safest use is in the multipara with no more than moderate hemorrhage from low implantation of the placenta. Antibiotics are of value since the onset and progress of labor may be delayed and patients with placenta previa are predisposed to infection, largely because of blood loss. In patients who fail to go into labor after rupture of the membranes or in whom labor is of the inertia type it is not safe to use pituitary extract even by the slow drip intravenous route. Even this new and safer method of administration may cause rupture of the friable lower segment of the uterus. When bleeding continues after rupture of the membranes, cesarean section may become necessary.

When the placenta is implanted largely in the lower segment of the uterus, the mechanism of spontaneous separation and extrusion may be impaired and retarded. The inability of the lower relaxed portion of the uterus to contract as effectively as the upper segment may delay separation. Further, poor contractility of the lower segment where large blood vessels have formed as a result of previa may prevent effective hemostasis.

Hemorrhage may also result from lacerations in the highly vascular, friable lower uterine segments and cervix. The patient is predisposed to postpartum hemorrhage which when superimposed on inadequately treated antepartum hemorrhage may be sufficient to cause irreversible shock and death. The operator must be prepared to be prompt in manual removal of the placenta should hemorrhage accompany faulty or delayed separation. Manual removal of the placenta is not regarded as a dangerous procedure if it is done properly and not too late. The prophylactic use of antibiotics makes

the risk of subsequent infection minimal. One should not wait until blood loss is great before attempting it since undue haste is more likely to result in trauma to the uterus. The technic is not difficult. Under anesthesia the external hand manipulates the fundus while the internal hand follows the cord to the placenta and then separates it from the uterus. Once the cleavage plane is located, separation becomes easy. After separation the placenta and membranes may be delivered into the vagina by traction on the cord. The hand remains in the uterus to explore thoroughly for retained cotyledons of the placenta or possible rupture of the lower segment of the uterus. Combined internal and external massage will help to produce uterine contraction and hemostasis. With this technic reintroduction of the hand into the uterus is not necessary and this reduces the risk of infection.

In a previous article in this series on postpartum hemorrhage we asserted that the uterovaginal pack is valueless. In placenta previa, with the increased friability of the lower uterine segment, packing is not only ineffective in producing hemostasis but also may cause rupture. The patient in this case actually died of postpartum hemorrhage. If immediate transfusion and hysterectomy were substituted for the packing, she probably would have survived.

The abdominal binder is a relic of the dead past. And the lateral pads? Too much is expected of them.

* * * *

Case IV. A twenty-eight year old white primipara was admitted to the hospital at twenty-eight weeks of gestation because of slight vaginal hemorrhage the previous day. Slight bloody vaginal discharge was noted on admission. The presentation was vertex and the fetal heart was heard. A cystogram suggested placenta previa. It was decided to follow the expectant plan of treatment and, accordingly, the patient was kept in bed in the hospital for the next three weeks. During this time only occasional slight vaginal bleeding was noted. At the end of this period a sudden gush of blood occurred. The staff decided to examine the patient vaginally, with the idea of rupturing the membranes or performing cesarean section if previa was found. However, examination in the operating room failed to disclose placenta previa and the patient was sent back to bed. There was no further bleeding until five days later when a second sterile vaginal examination found the internal os completely covered by the placenta. A transfusion of 500 cc. of blood was given and a lower segment cesarean section performed under general anesthesia. Her postoperative course was characterized by the symptoms and findings of sepsis, and she died of peritonitis six days after the operation.

Questions. (1) How valuable is the x-ray diagnosis of placenta previa? (2) How dangerous is a single or repeated vaginal examination in placenta previa? How should the vaginal examination be done? (3) Is expectant management of placenta previa ever justified? (4) When should cesarean section be performed for a patient with placenta previa?

Answers. In experienced hands the x-ray diagnosis of placenta previa may be of some aid. The cystogram is generally not as accurate as the soft tissue technic. In the cystogram about 40 cc. of air or a radiopaque solution such as a 12.5 per cent solution of sodium iodide is instilled into the bladder. With pressure applied to the fundus anteroposterior and lateral plates are taken. When the fetus is in vertex presentation, placenta previa will generally cause a widening and asymmetry of the space between the fetal vertex and the bladder shadow. In the soft tissue x-ray technic an attempt is made actually to visualize the placenta. If it is found in the upper segment, placenta previa is ruled out. In the most expert hands it is said to have an accuracy of 80 to 85 per cent and is favored over the cystogram method. Indirect light coming from an ordinary goose-neck lamp is better than the x-ray viewing box in searching for the placental shadow. In both x-ray methods the lateral plate is more valuable than the anteroposterior plate, for the placenta is generally implanted largely on either the posterior or anterior wall of the uterus. When x-rays are taken, a full view of the fetus should be obtained, for congenital malformations of the fetus which occur frequently with placenta previa may be recognized.

From a practical point of view x-ray diagnosis cannot be relied upon to make the diagnosis. Vaginal examination is the surest method and is recommended. When properly carried out a single vaginal examination is safe. *It*

should be performed only in the operating room with all preparations made for immediate treatment should previa be found. Nurses and assistants should be scrubbed and standing by. One thousand cubic centimeters of blood should be on hand since the examination may separate more of the placenta, displace a clot and precipitate severe hemorrhage.

As in this case placenta previa may be present and yet not found if great care is not exercised in the examination. One should first be familiar with the feel of the placenta. It is quite characteristic and can be described as spongy, granular or gritty. One may practice by taking a placenta after delivery and placing it over a circle made by the fingers and then feeling it through the circle with the eyes closed and rubber gloves on. It must be distinguished from a blood clot. The examination should begin by spreading the vagina widely with specula and carefully inspecting the cervix for erosion, polyps, varices, carcinoma or evidence of trauma. The vagina must also be inspected. (In a recent case seen by one of us a patient thirty weeks pregnant gave a history of spontaneous, painless hemorrhage, but on speculum examination evidence of trauma to the cervix and vault of the vagina could be seen. The patient later admitted an attempt at self-induction.) A finger should then *gently* be introduced through the internal os of the cervix. Since the cervix in placenta previa is generally larger, softer and more patulous, this can usually be done. One should not poke at the placenta since this will separate more than is necessary and aggravate the hemorrhage.

Vaginal examination may be made extremely difficult by finding a rigid, closed, uneffaced cervix, but this is unusual in cases of placenta previa. One must not dilate such a cervix but be content with fundal pressure and feeling about the portio vaginalis of the cervix through the lower segment of the uterus. If the fetal skull is felt all about, previa is unlikely. Occasionally one may get the sensation of a mass between the fetal head and lower segment on one side; this may suggest previa.

The single vaginal examination done just prior to cesarean section is reasonably safe. A second vaginal examination, however, some days after the first and followed with cesarean section is considerably more dangerous. Although the original examination may have been carefully performed, bacteria are carried into the bloody area of placental separation. A later examination may disturb the area of infarction in which bacteria are multiplying in excellent culture media, encourage invasion and result in fatal peritonitis later postoperatively.

The expectant treatment of placenta previa may be made safe. The initial hemorrhage is rarely if ever catastrophic, and apart from cervical manipulation or the onset of labor, even recurrent hemorrhages are not apt to be fatal. The gravity of placenta previa must not be minimized, yet it is clear that if the patient is not actively bleeding and can remain in a hospital under close observation with adequate amounts of compatible blood immediately available, the expectant plan can be followed. It should be borne in mind that the multipara is more prone to sudden and profuse hemorrhage. Fetal salvage can be increased with expectant management. Deferment of treatment for even two to three weeks will often materially increase the chances for fetal survival. One must arbitrarily set a definite date after which expectant treatment is no longer indicated. This probably lies between the thirty-fourth and thirty-sixth week. The estimated size of the fetus will undoubtedly influence one's judgment considerably.

The expectant plan of management at home is not recommended. If hemorrhage should occur, much time is lost before adequate therapy is instituted. When patients are followed expectantly in the hospital, repeated estimation of the hemoglobin may be necessary; it is particularly indicated after an episode of bleeding. The Talquist method is unsatisfactory because of the great margin of error. The hemoglobin must be kept at at least 70 per cent, by transfusion if necessary.

The modern treatment of placenta previa includes termination of the pregnancy by cesarean section or by induction of labor from rupture of the membranes. Cesarean section is more often indicated. It should be elected when the previa is partial or complete or when there is an undilated, uneffaced or primiparous cervix. Massive hemorrhage is best treated this way despite the degree of previa for it may indicate marked vascularity of the lower uterine segment and cervix, a condition which makes vaginal delivery hazardous. Advances in technic now offer greater safety for the patient. Abdominal delivery tends to retain the limited hemostatic power which the lower uterine

segment possesses and thus danger of postpartum hemorrhage after cesarean section is less than after vaginal delivery. The undesirable and dangerous sequelae from trauma to the cervix and lower uterine segment are avoided. Hemorrhage can be promptly controlled since delivery is generally quickly accomplished. There is also considerably greater fetal survival. Shock is an immediate contraindication to any form of operative treatment. Since hemorrhage, however profuse, tends to be intermittent and rarely kills, there is time to treat the shock. *This must include massive blood transfusion.*

We perform the lower segment operation for placenta previa. During this procedure the placental implantation site may be seen. Wallace clamps are placed on the margins of the uterine incision which are brought up into view and inspected. Bleeding vessels may easily be identified, clamped and ligated. It is routine during this cesarean section to give blood by transfusion for bleeding may be profuse. The choice of the anesthetic agent is important. If active bleeding does not make speed necessary, general anesthesia should not be selected. A fetus already in jeopardy because of maternal blood loss will become more anoxic from respiratory depression after delivery. Local anesthesia supplemented by intravenous drip sodium pentothal® or regional anesthesia such as epidural or fractional spinal anesthesia are preferred. It is good to have a pediatrician in attendance as anoxia and prematurity demand expert attention.

* * * *

CASE V. The patient was a white thirty-two year old female, para III, who during her thirty-fourth week of pregnancy suffered a moderate vaginal hemorrhage while asleep at home. Her physician inserted a vaginal pack and transported her to the hospital. On general and abdominal examination she was thought to have a normal pregnancy. The vaginal pack was removed the following day with slight recurrence of vaginal bleeding. A sterile vaginal examination showed a small, bleeding polyp and it was concluded that this was the cause of the bleeding. Accordingly she was sent home.

More severe bleeding occurred eight days later and the patient was readmitted to the hospital. Vaginal examination now showed a partial placenta previa. A lower segment cesarean section was performed. There was some difficulty in extracting the placenta but this was finally accomplished. The fetus was alive. During the patient's postoperative period she continued to bleed moderately from the vagina and the cause for this was never ascertained. She showed clinical evidence of spreading peritonitis postoperatively and despite the use of some sulfonamides and antibiotics died six days later.

Questions. (1) Is the use of a vaginal pack ever indicated in placenta previa? (2) Does the finding of a cervical polyp or erosion necessarily exclude previa? (3) When should just a speculum examination be made? (4) What is a likely cause for the continued postoperative bleeding? (5) What was the cause for difficulty in placental removal?

Answers. The use of a vaginal pack is never indicated. It is not only useless but also dangerous.

The finding of a cervical polyp or erosion which bleeds when touched with a cotton applicator is presumptive evidence of the cause for slight vaginal bleeding. But, as in this case, it does not exclude placenta previa which should be suspected despite the presence of such cervical lesions if hemorrhage has been more than slight. However, when the expectant plan of management is followed because of the prematurity of the fetus, simple, cautious, sterile vaginal speculum examination in the hospital is all that is necessary for initial slight vaginal bleeding. Such speculum examination is indicated shortly after the patient is admitted to the hospital. Carcinoma of the cervix associated with pregnancy occurs frequently enough to be borne always in mind. The marked increased rate of growth of the carcinoma in such patients makes early diagnosis and treatment imperative. A delay of a few weeks during expectant management will make the prognosis graver. In at least 20 per cent of patients with vaginal bleeding in the third trimester of pregnancy and before the onset of labor neither speculum or digital examination nor examination of the placenta after delivery will disclose the cause for the bleeding. Actually placenta previa is the cause in about one-third of the cases.

This patient was unnecessarily infected prior to cesarean section. Of greater importance than the use of drugs to combat infection or large

amounts of blood to replace blood loss is good judgment in selection of the time and method of treatment. All our modern therapy may fail to save the mismanaged patient. Patients rarely die of the previa alone, but rather from the added effects of inadequate or faulty treatment.

The continued vaginal bleeding may have been due to retained placental tissue which incidentally may have aided in continuing and spreading the infection. It is just as important to examine the placenta to see if it is complete after abdominal as after vaginal delivery.

We do not know how this placenta was removed or what made its removal difficult. The uterine incision may have been too small; the placenta may have been fragmented by an incision carried through it; or it may have been large, thin, spread out and partially in the upper segment. Or, less likely, the operator may have tried to express it by what is called the Credé maneuver.

Good management of the placental stage is vital. If the placenta is found on the anterior uterine wall, the incision must be carried through it *expeditiously and with good judgment.* No form of expression, whether carried on through the abdominal wall or upon the uterine fundus itself, should be practiced. The placenta should be removed manually and carefully with due regard to the possibility of wide coverage.

* * * *

Case vi. A twenty-nine year old white primipara suddenly experienced profuse vaginal hemorrhage when about thirty-eight weeks pregnant. Two hours later with the onset of labor the patient noted a gush of bright red blood and clots with each pain. Dilatation of the cervix progressed to 4 cm. after four hours of labor. The fetal heart could no longer be heard, the pains lessened and the bleeding slowed. The estimated blood lost at this time was about 2,000 cc.

On admission to the hospital the patient was in shock. She was pale, apathetic and clammy. The pulse was 150 and the blood pressure 70/50. The red blood count was 3,270,000. Plasma and whole blood were given; and when the general condition of the patient improved, vaginal examination was performed. A total placenta previa was found. The cervix was manually dilated from 4 to 7 cm. and a No. 4 Voorhees bag inserted. The patient went into shock again and complained of severe abdominal pain. Her abdomen became board-like and the fundus rose higher. She was unconscious and her blood pressure could not be obtained. The bag was removed and more blood and plasma were given by transfusion.

The patient was now prepared for delivery. The cervix was manually dilated further. A hole was made through the placenta and by podalic version and extraction a thirty-eight week old stillborn fetus weighing 6 pounds, 1 ounce was delivered.

The general condition of the patient improved slowly after repeated transfusions were given. Her postpartum course during the first four days was septic but after this period the temperature fell to normal and remained so until the ninth day when the patient suddenly died.

At autopsy the right pulmonary artery was found to be occluded by a large antemortem thrombus. The veins in both broad ligaments showed antemortem thrombi and there was pathologic evidence of acute septic endometritis.

Questions. (1) Is manual dilation of the cervix ever indicated in the treatment of placenta previa? (2) What would have been proper treatment for this patient? (3) Is it ever advisable to make a hole in the placenta? (4) Is massive hemorrhage evidence of total coverage?

Answers. This patient illustrates massive hemorrhage that can occur in patients with placenta previa, especially when the type is total. However, massive hemorrhage does not necessarily indicate total coverage. The type of placenta cannot be foretold either by the amount or suddenness of the blood loss or by the time it occurs. Manual dilation of the cervix, better termed "manual laceration," if ever indicated is condemned in patients with placenta previa because of the increased friability of the cervix and lower uterine segment. It is never advisable to make a hole in the placenta.

The treatment of this patient is open to great criticism. She apparently tolerated procedures well calculated to cause rupture of the uterus, namely, manual dilation of the cervix, podalic version and extraction, only to succumb to infection and embolism later. The use of the bag was likewise ill advised. When vaginal examination disclosed total previa, a cesarean section should have been performed.

SUMMARY

1. Although the history is often significant, the diagnosis of placenta previa can be made only by vaginal examination. X-ray technics are helpful but not absolute. Rectal examination is contraindicated. The digital vaginal examination should be made only in the operating room after preparations have been taken for immediate treatment should placenta previa be found.

2. Expectant management in the hospital is advised in patients before the thirty-seventh week of gestation if the bleeding is not excessive. All patients with bleeding who are being treated expectantly should have a speculum examination shortly after admission. The possible occurrence of carcinoma must always be considered.

3. For practical purposes treatment consists of rupture of the membranes or cesarean section. Vaginal packing, Braxton Hicks' version and the dilating bag are, in our opinion, obsolete.

4. The need for blood is great. Blood lost during antepartum, intrapartum and postpartum periods must be replaced. Transfusion given after irreversible shock has occurred is without value.

BURNETT et al. have had very favorable results in the treatment of empyema by delaying surgery a few days while they first aspirated the empyema cavity and reinstilled adequate amounts of penicillin (occasionally other antibiotics may also be needed). Only about 20 per cent of their patients failed to respond to such measures and had to be operated upon. (*Richard A. Leonardo, M.D.*)

Streamlined Articles

INTERLOCKING OR COLLISION OF TWINS DYSTOCIA*

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INTERLOCKING or collision of twins dystocia is a rare obstetric complication and should be watched for during delivery of twins. True interlocking of heads occurs when the aftercoming head of the first twin in breech presentation is arrested at the pelvic inlet by the head of the second twin in vertex. Collision of twins occurs when two presenting parts at the inlet interfere with the entrance of either into the pelvic canal, or when the head of one twin is arrested by the trunk of the other.

Treatment depends upon the parity and condition of the patient, the size and positions of the infants. Review of the literature reveals case reports of interlocking and collision of twins treated by dislodgment of the heads, decapitation and by section.

A case of collision of twins, treated by section, in a thirty-one year old white primigravida caused by arrest of the head of the second twin against and producing a crushing deformity of the anterior chest of the first twin attempting to engage as a breech, is presented. Examples of collision are: (1) two heads attempting to engage simultaneously, the head of the second twin catching in the neck of the first; (2) two breeches attempting to engage simultaneously; (3) arrest of the aftercoming head of the first twin in breech presentation against the trunk of the second in transverse lie and (4) arrest of the head of the second twin against the thorax of the first twin attempting to engage as a breech.

* * * *

CASE REPORT

A thirty-one year old white primigravida at term was admitted to St. Elizabeth's Hospital in active labor on February 1, 1946, at 12:30 A.M. Her membranes had ruptured one hour prior to admission to the hospital.

Her last menstrual period occurred April 18, 1945, and the expected date of delivery was January 25, 1946. Her prenatal course was uneventful, and the twin pregnancy was diagnosed two months previously. Her pelvic measurements were adequate clinically and by pelvimetry.

Laboratory data were as follows: The Kahn test was negative. The urine revealed a specific gravity of 1.020, no albumin and no sugar. Her hemoglobin was 82 gm. per cent (Sahli); the erythrocytes numbered 4,480,000; leukocytes 9,400 per cu. mm.

On admission to the hospital the patient was having strong regular uterine contractions of five-minute intervals lasting one-half minute. The abdominal wall was thin and fetal parts could be easily palpated. A breech was presenting over the pelvic inlet and the head could be palpated in the left upper portion of the abdomen. The breech of the second twin could be felt in the right upper abdomen. Two sets of fetal heart tones could be heard. Rectal examination one hour after admission revealed the cervix effaced and thin with approximately 5 cm. dilatation. The presenting breech over the pelvic inlet could be touched with the rectal examining finger.

Her contractions continued regular and strong, but she failed to make any progress after fourteen hours of labor. A sterile vaginal examination done at 2:00 P.M. revealed the cervix thin with about 6 cm. dilatation. X-ray films of the abdomen in the anteroposterior and lateral positions showed one twin attempting to engage as a breech with the thighs alongside the abdomen, and the head of the second twin impacted against the lower anterior chest of the first twin. (Figs. 1 and 2.) A diagnosis of dystocia due to collision of twins was made and it was deemed advisable to deliver her by sec-

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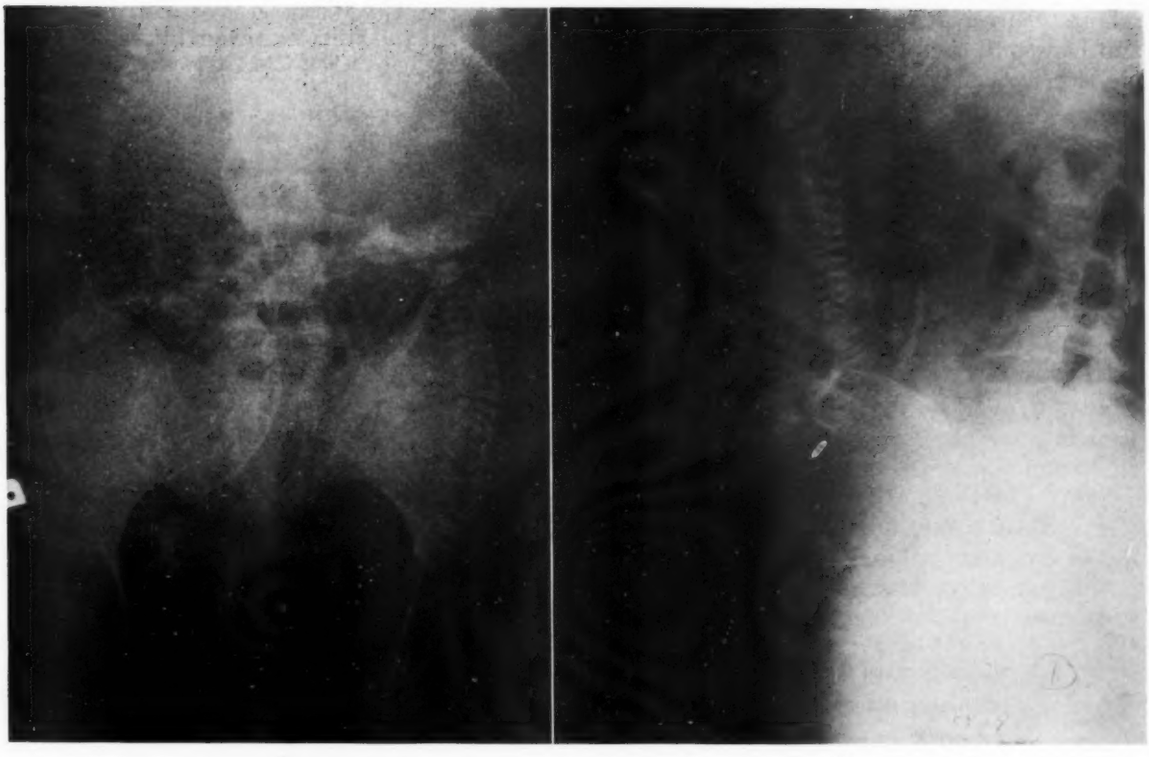

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FIG. 1. Anteroposterior view taken after ten hours of labor showing impaction of head of the second twin against the chest of the first twin.
FIG. 2. Lateral view showing the first twin attempting to engage in the pelvic inlet as a breech.

tion. A low transperitoneal section was performed under general anesthesia at 3:15 P.M., fifteen hours following onset of labor. The first twin (breech) was a male infant weighing six pounds, four ounces. There was a crushed deformity of the lower anterior chest caused by impaction of the head of the second twin. The respiratory movements of this infant were delayed and, following resuscitation with an intratracheal catheter were irregular and jerky. He was placed under oxygen but remained cyanotic and expired two hours following birth. The second twin was a female weighing five pounds, eight ounces, and had spontaneous regular respiratory movements and a lusty cry. The patient and the female twin were discharged from the hospital on the tenth postoperative day.

COMMENT

Interlocking or collision of twins usually cannot be predicted before the onset of labor. However, when a diagnosis of twin pregnancy has been made, this complication should be watched for carefully. McCormick[1] quotes the following possible combinations of presentations of twins:

	Per cent	
Two heads	38	
Head and breech	35	
Two breeches	10	
Head and transverse lie	9	15
Breech and transverse lie	5	
Two transverse lie	1	

The proper treatment will depend upon the parity and condition of the patient, the size and positions of the infants as determined by x-ray films plus a careful abdominal and vaginal examination. One's ingenuity will assist him in choosing section, dislodgment, version or decapitation. Textbooks on obstetrics show illustrations of locked twins with one twin being born as a breech with the aftercoming head locked with the head of the second twin entering the pelvic brim. When this complication occurs, it may be necessary to decapitate the breech twin, disengage the heads, deliver the second twin and then allow the severed head to be born spontaneously.[2–7] Occasionally if the heads are small, they may be dislodged and the

infants delivered without injury.[2–9] Peters[10] and Dawson[11] each present a cast of interlocking twins which were delivered by section.

REFERENCES

1. McCormick, C. O. A Textbook on Pathology of Labor, the Puerperium and The Newborn, p. 125. St. Louis, 1947. C. V. Mosby Co.
2. DeLee, J. B. The Principles and Practice of Obstetrics, p. 520. Philadelphia, 1934. W. B. Saunders Co.
3. Beck, A. C. Obstetrical Practice, p. 466. Baltimore, 1942. Williams & Wilkins Co.
4. Holmes, R. and Evans, C. B. S. Gynecology and Obstetrics, Chapt. 17, p. 18. Hagerstown, Md., 1938. W. F. Prior Co.
5. Titus, P. The Management of Obstetric Difficulties, p. 327. St. Louis, 1937. C. V. Mosby Co.
6. MacDonald, I. Case of locked twins. *Brit. M. J.*, 2: 1214, 1912.
7. Geggie, J. Hans S. Locked twins. *Canad. M. A. J.*, 57: 381, 1947.
8. Greig, D. S. A case of locked twins. *Brit. M. J.*, 1: 13, 1946.
9. Cunningham, W. D. A case of locked twins. *M. J. Australia*, 1: 494, 1947.
10. Dawson, J. B. Interlocked twins treated by caesarean section. *J. Obst. & Gynaec. Brit. Emp.*, 43: 507–510, 1936.
11. Peters, L. Interlocking or collision of twins—dystocia—low cesarean delivery. *California & West. Med.*, 46: 403–405, 1937.

When performing ureterosigmoid anastomosis, recent studies point to the advisability of abandoning the submucous tunnel, of directly anastomosing mucosa to mucosa and of disturbing the ureter as little as possible. Thus we now attempt to bring the sigmoid up to the ureter at the site of junction instead of vice versa. Results appear to be better with this type of technic. (*Richard A. Leonardo, M.D.*)

AN ELECTRICAL METHOD FOR THE PREVENTION OF VENOUS THROMBOSIS AND PULMONARY EMBOLISM*

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THERE is little need these days to remind readers of the value of early movement after operation as a preventive of venous thrombosis and pulmonary infarction. Some years ago it occurred to us that venous stasis might be overcome by the artificial induction of muscle activity (e.g., by rhythmical electrical stimulation), thus becoming a useful procedure for combating certain forms of peripheral circulatory failure, thrombosis and embolism. We proceeded along these lines in a small series of cases (seventy-six patients) and at the time of this writing there has been no sign of thrombosis or embolism in any of the patients studied.

* * * *

Many patients fear or resent the attendant discomfort of early movement after operation. In others unconsciousness, weakness or senility may exclude active movement. In all of these cases passive movement might supply the answer; however, passive movement and massage on a large scale in a big hospital with many operations is expensive. Any other procedure that ensures movement of venous blood without discomfort should therefore be a welcome addition to postoperative treatment not only to prevent venous thrombosis but also to avoid peripheral circulatory failure.

The physiologic considerations involved are as follows: Circulation is maintained by three sets of pumps strategically placed along the blood circuit, namely, the heart, voluntary muscles and diaphragm. One of the essentials for efficient cardiac activity is a mechanism for returning an adequate volume of venous blood to the heart. This is maintained by skeletal muscle contractions (muscle pump) and by the piston-like action of the diaphragm during respiration (respiratory pump). Increased muscular activity therefore automatically tends to increase cardiac inflow and output.

Our methods of controlling circulatory failure and the results obtained were reported in 1947[1] and 1948.[2] A proper evaluation of any method for control of thrombosis and embolism, however, requires a long time and the examination of hundreds or thousands of patients. We are presenting this small group of cases, therefore, in the hope that others will be encouraged to make similar observations and thus allow valid conclusions as to the efficacy of the method to be made at an earlier date.

Thrombi form most often in the legs, especially in the veins of the muscles of the calf and foot. After some preliminary experimentation the following apparatus was found to give satisfactory results:

Source and Type of Electrical Current. Passive muscular contractions in the thigh and calf were induced by a sinusoidal current (surging interrupted direct current with alternating polarity) from a Burdick Morse Wave generator M-210 at an intensity and frequency comfortable to the individual subject. This was usually at 20 to 30 milliamperes intensity and at a rate of 18 to 20 contractions per minute. The large generator has now been replaced by a much handier, small portable model weighing only 15 pounds.†

Electrodes. In the early experiments the dispersive electrode applied to the lumbosacral region consisted of a thin stockinet girdle soaked in warm saline with Crooke's metal contact. This was covered with rubber sheeting and held in place by a many tailed surgical binder. The active electrodes were spiral muslin binders of fourfold thickness applied damp and as warm as tolerated from the ankle to groin. One-half-inch ribbons of Crooke's metal were spiraled the full length of the binders and the whole covered with oiled silk held in place with ace bandages.

† This was made for us by the Burdick Corporation of Milton, Wis.

* From the Departments of Pathology and Physiotherapy, Medical College of Virginia, Richmond, Va.

In later experiments the dispersive electrode consisted of a thick square Burdick electrode pad 10 by 10 inches thoroughly moistened with warm normal saline and held firmly in place over the lumbosacral region with a many tailed binder. The active electrodes were similar rectangular pads 3 by 12 inches each applied to the dorsal surface of the calves and held with binders of dental dam rubber. Bifurcated and single leads connected the active and dispersive electrodes respectively to the generator.

TABLE I
AGE DISTRIBUTION IN THIS SERIES (SEVENTY-SIX CASES)

Age (yr.)	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89
No.	1	11	20	15	12	11	5	1
Per cent	1.3	15	27	20	16	15	6.7	1.3

TABLE II
OPERATIONS PERFORMED IN THIS SERIES

Gastrointestinal tract (cancer, ulcers, plastic operations)	12
Cholecystectomy	14
Hysterectomy	19
Hernia (diaphragm, umbilicus, inguinal)	6
Delivery and sterilization	6
Thoracic, various	3
Others (prostate, sympathectomy,* abdominal stab, sarcoma, thyroidectomy, mastectomy)	16
	76

* Died in uremia 5 wk. later

Time and Length of Treatment. Following the demonstration by Kniseley et al.[3] that sludging of blood begins immediately after injury we begin treatment of all patients as soon as possible after operation. Our usual custom is to maintain stimulation of muscle movement for ten to fifteen minutes in each hour for several hours. In some cases a course of stimulation was given on the next or even on a third day depending on circumstances.

In collecting this small group of patients (Tables I and II) we have deliberately selected those which experience has shown are most liable to postoperative thrombosis, i.e., those subjected to extensive pelvic or abdominal surgery and especially those over fifty years of age. A few other cases are also included.

REFERENCES

1. CARY, M. K., APPERLY, F. L. and HELLEBRANDT, F. A. Influence of various physical therapeutic measures on the course of gravity shock. *Federation Proc.*, 6: 87, 1947.
2. APPERLY, F. L. and CARY, M. K. The control of circulatory stasis by the electrical stimulation of large muscle groups. *Am. J. M. Sc.*, 216: 403, 1948.
3. KNISELY, M. H., ELIOT, T. S. and BLOCH, E. H. Sludged blood in traumatic shock. *Arch. Surg.*, 51: 220, 1945.

Case Reports

MALIGNANT OVARIAN TERATOMAS IN THE FIRST TWO DECADES OF LIFE*

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New York, New York

TERATOMAS of the ovary although infrequent in the first two decades of life are not rare. They constitute the most common tumor of the premenstrual years,[1,2] usually occurring in the first half of the second decade.[3] To the middle of 1949 about 150 authentic cases are found in the literature including those reported as dermoids. Examples of the coincidental involvement of the same ovary by a malignant tumor and a non-malignant teratoma such as reported by Goodfriend and Caruso[4] are not included. In addition to individual case reports there are several excellent longer articles.[2,5–12] Since the publications of Wakely[11] and Witzberger and Agerty[12] twenty-four more cases have been found.[13–24] Ten are benign and fourteen malignant. Of the total number approximately one-third have shown evidence of malignancy. The early literature usually deals with benign tumors. In the more recent publications malignant disease is more frequent, probably, as suggested by Downes,[25] due to more thorough histologic examination. The purpose of the present communication is to review the recent literature on malignant ovarian teratomas of the first two decades and to report two additional cases which illustrate some of the important features of these tumors.

CASE REPORTS

CASE 1. The onset of illness in this patient, a seven year old child, was a sharp attack of severe abdominal pain simulating acute appendicitis. An emergency laparotomy was carried out on November 26, 1948, with that preoperative diagnosis. When the abdomen was opened, about 300 to 400 cc. of bloody fluid with clots were found. There was torsion of the right ovary which had a hemorrhagic cyst and a small perforation. The appendix and small intestine were normal. The cyst was resected and the appendix removed. The postoperative course was uneventful and the patient was discharged on December 1, 1948.

The pathologic report was as follows: The cystic right ovary measured 5.4 by 5 by 3.3 cm. and was purple in color. On the surface there was a raised lentiform white nodule. On section the cyst was filled with fluid blood. The wall was purple-black and about 9 mm. thick. The posterior surface had a ragged rent.

Microscopically, the wall was edematous and hemorrhagic. There were normal stroma and some primordial follicles. The teratomatous tissues were characterized by an embryonal appearance. The most abundant was the skin and its appendages of hair and sebaceous glands. Sometimes the squamous epithelium merged with glandular structures lined by tall ciliated epithelium. There was abundant actively growing bone, with or without foci of calcification, fibro-elastic cartilage, glial tissue and loose areolar tissue. Some structures were organoid and resembled bone with synovial cavity in architectural pattern. None of the tissues had any of the histologic criteria of malignancy. The diagnosis was teratoma of ovary with torsion.

The patient was readmitted five months later on April 24, 1949. One week previously she had had an attack of vomiting and enlargement of the abdomen was discovered. For the entire week there was intermittent fever, diarrhea and extreme flatulence.

* From Doctors Hospital, New York, N.Y.

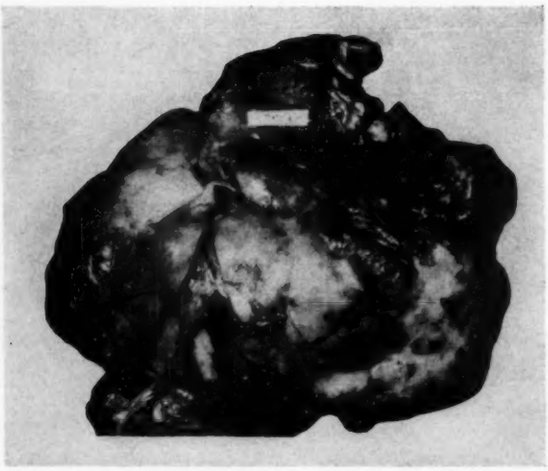


FIG. 1. Case 1. The nodular mass found replacing the right ovarian tissue left at the first operation.

On examination the patient appeared acutely ill. Her face was flushed and her temperature was 103.8°F. The abdomen was distended, slightly tender under the old scar and felt cystic. Laparotomy was performed the next day.

The segment of right ovary left at the first operation was replaced by a mass larger than a football and adherent to sigmoid and omentum. (Fig. 1.) Innumerable masses of various sizes were scattered over the peritoneum and omentum; one, 8 cm. in diameter, was adherent to the sigmoid. The left ovary appeared normal. The right ovarian, the sigmoidal and an omental mass were removed. The patient was discharged on May 2nd.

The pathologic report revealed the following: The right ovarian mass was grossly nodular, had a smooth, intact serosa and measured 19 by 13 by 6 cm. It felt soft and cystic. On section there were numerous cysts of various sizes filled with pseudomucinous contents. The central portion was solid and had some amorphous, gritty particles. The other two masses were similar.

Microscopically, all the tumors were similar and contained both adult and embryonal tissues. There were connective tissue, adipose tissue, involuntary muscle, young and adult voluntary muscle, developing bone, fibro-elastic cartilage, adult skin with accessory structures and neurogenic tissue. No pattern was followed; all the tissues were intermingled. (Fig. 2.)

The cysts were of various types. Skin with hair shafts and sebaceous glands lined some. In others the squamous epithelium merged with epithelium of respiratory type which was associated with mixed seromucous glands. It merged sometimes with non-ciliated epithelium covering villous projections mimicking small bowel folds. Occasionally it merged with a cystic lining of ependymal nature, lying in adult glial tissue. Other cavities had tall, ciliated, mucus-producing cells. Ciliated columnar cells with nests of non-ciliated mucous cells lined other cavities. Occasionally these cysts had transitional epithelium. There were some structures with lining similar to large bowel. A few areas had structures like fallopian tube and choroid plexus.

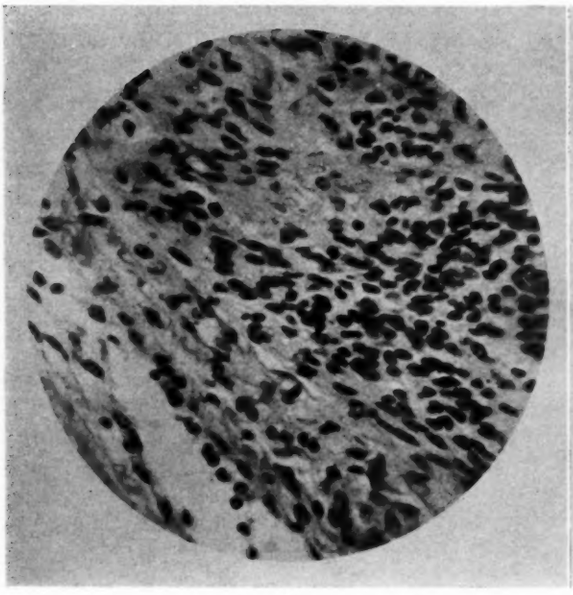
The neurogenic tissue was abundant. Chiefly it was adult glia, sometimes embryonal glia with normal mitoses. Sometimes both were intermingled. The glia frequently had small cavities lined with ependyma resembling the central canal of the spinal cord. Some areas of edema formed cavities. There were some neurones with Nissl granules. There were a few adult nerves and one ganglion similar to those of the sympathetic chain. Normal ovarian tissue was not found. The diagnosis was recurrent teratoma of the right ovary and metastatic teratoma of the peritoneum. (Fig. 3.)

Roentgentherapy was carried out from May 9th to June 10th through two anterior and two posterior portals, each 15 by 10 cm. The total dosages measured in air were as follows: anterior right pelvis and abdomen, 1,550 r; anterior left pelvis and abdomen, 1,550 r; posterior right pelvis and abdomen, 1,600 r; and posterior left pelvis and abdomen, 1,600 r. The factors at 50 cm. T.S.D. were KV 200 M A 8 filter mm. ½ Cu 1 Al.

When last seen in November the patient appeared well, was in good health and apparently free of metastases.

CASE II. The current illness of the patient, nineteen years of age, was of two to three weeks' duration and was characterized by left lower quadrant pain. It began about five days before the last menstrual period and continued after menstruation ceased. The pain was sufficiently severe to prevent continuing at work. The menses previously had always been regular. On examination on May 14, 1949, a cystic mass was palpable in the left ovarian area.

Laparotomy was performed two days later. The left ovary was lying on the right side, twisted 180 degrees, the size of a grapefruit



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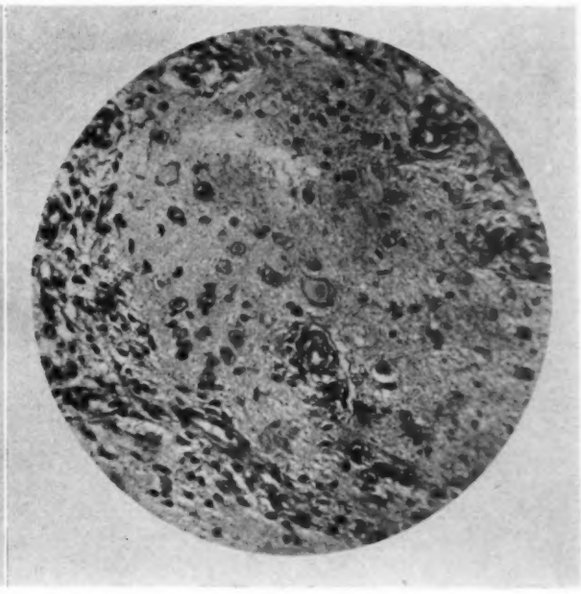

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FIG. 2. Case 1. Moderately cellular embryonal tissue showing some normal mitoses, found in the recurrent and metastatic lesions. × 600.

FIG. 3. Case 1. Neurogenic tissue with both adult glial cells and neurones with Nissl granules.

and multilocular. The right ovary was solid and as large as a baseball. There were some omental adhesions from a previous appendectomy. The masses were resected leaving some ovarian tissue on each side.

The pathologic report revealed the following: The left ovary was roughly ovoid, had a smooth outer surface with prominent vessels, felt almost cystic and measured 8 by 7.5 by 6 cm. On section it was made up largely of a solid nodule of gelatinous appearance with coarse fibrous bands producing the appearance of thyroid tissue. (Fig. 4.) A slit-like cavity containing milky fluid separated the central mass from the peripheral zone. One part of the wall was bony hard.

The right ovary was smooth, cystic, measured 13 by 9.5 by 6 cm. and had some doughy masses presenting externally. On section there were two cysts separated by a calcified ridge. Both cysts contained light yellow fluid. At one pole of the larger cyst there was a secondary cavity containing sebaceous material and hair and a calcified mass in the wall. Several small, soft nodules in the wall had a yellow-white cut surface. In the wall of the smaller cyst there was a secondary cyst containing sebaceous material, hair and a calcified mass.

Microscopically, the most prominent component of the left ovary was glial tissue, mainly

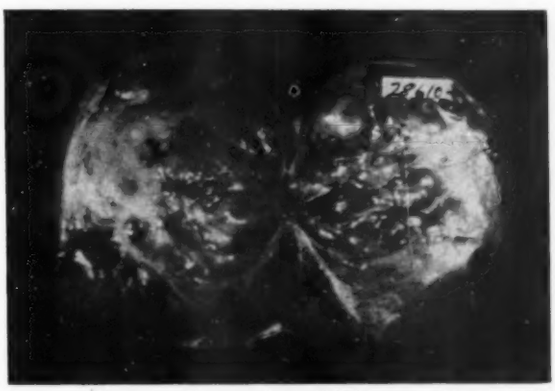

FIG. 4. Case II. Cut surface of left ovary has a solid gelatinous appearance with coarse fibrosis producing the appearance of thyroid tissue.

very cellular, embryonal in type, extremely atypical, rich in normal and abnormal mitoses and showing rosette formation. The tissue was extremely edematous, particularly in the solid central mass which resembled thyroid to the naked eye. A few small cavities appeared lined by ependyma. Some areas had adult and embryonal skin with sebaceous glands and hair follicles. They overlay adipose tissue and cancellous bone. (Figs. 5 and 6.)

The right ovary had adult tissues. The small cyst was lined by skin with hair, sebaceous and sweat glands, merging into a multilayered ciliated epithelium which in turn led into a glial-

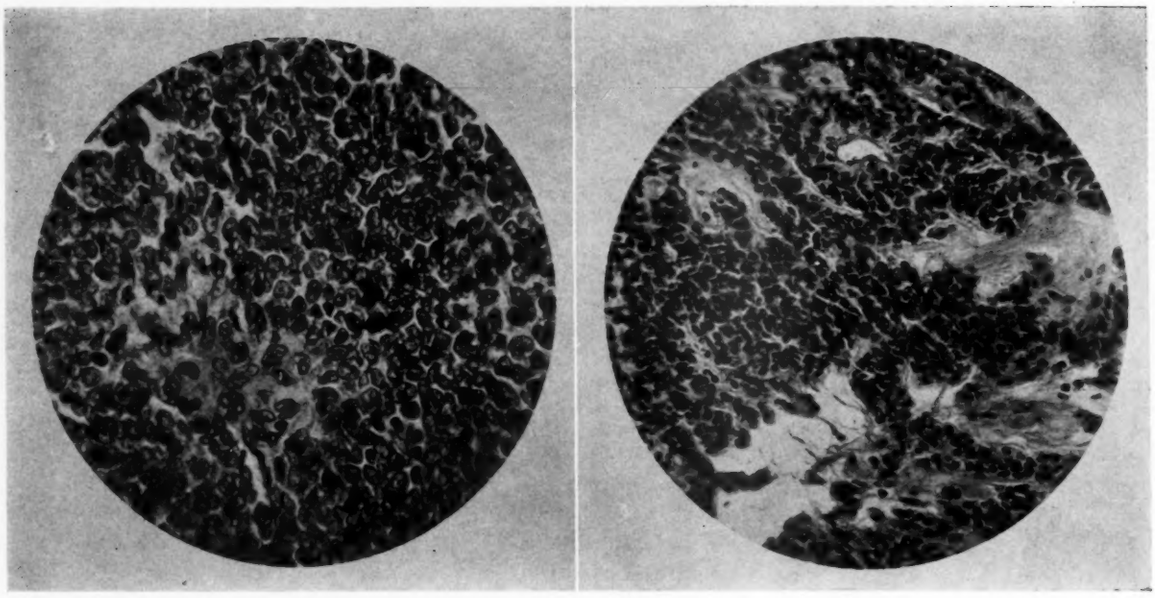

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FIG. 5. Case 11. Young embryonal tissue showing the great cellularity. × 600.
FIG. 6. The blastomatous glial tissue showing the atypical cells, numerous mitoses and rosette formation. × 600.

lined cavity. In the wall of the cyst there were structures like choroid plexus, adipose tissue, collagenous connective tissue and involuntary muscle. The large cyst had skin, sebaceous glands, subcutaneous adipose tissue and adult glia. Some of the glial foci had neuronal cells. There was some cancellous bone with fatty marrow in which foci of myelocytes and megakaryocytes were scattered. There was some moderately cellular young embryonal glia free of signs of rapid growth. A segment of normal ovarian stroma was present. The diagnosis was malignant teratoma of the left ovary with glioblastomatous foci and torsion, and nonmalignant teratoma of the right ovary.

A second laparotomy was done on May 25th. A supracervical hysterectomy and bilateral salpingo-oophorectomy were performed with complete removal of both broad ligaments. Microscopic examination showed organizing hematoma of the right ovary. Otherwise both had only normal tissue. Careful examination failed to reveal any evidence of tumor in any portion of the tissues removed. The patient was discharged on June 5th.

After leaving the hospital the patient received roentgentherapy from June 21st to August 12th through four portals each 10 by 15 cm. The total dosage measured in air was as follows: right anterior pelvic field, 2,075 r; left anterior pelvic field, 2,075 r; anterior upper mid-abdominal field, 1,500 r; and posterior upper mid-abdominal field, 1,500 r. The factors at 50 cm. T.S.D. were KV 200, filter 1 Cu 1 Al.

Roentgenograms taken of the chest and pelvis before therapy was given were negative. During the course of therapy there were two episodes of bleeding. On July 15th the patient bled after voiding. The urine had a faint trace of albumin and some erythrocytes. Nothing of note was found on physical examination. On July 29th the patient vomited and passed a dark colored stool. Again nothing of note was demonstrable. When last seen in November she remained free of symptoms and had returned to work. Examination, including fluoroscopy of the chest, had given no evidence of recurrence or metastasis.

COMMENTS

Solid teratomas of the ovary are usually considered potentially or definitely malignant and cystic tumors benign. These criteria are less valuable in the first two decades of life than at older age periods. Several of the tumors listed in Table 1 have shown both solid and cystic areas. Some, such as the case of Willis, have been chiefly cystic. Some of the solid teratomas, for example those of Baccarini and of Searby,

TABLE 1
MALIGNANT OVARIAN TERATOMAS

Author	Age	Symptoms	Site	Pathology	Outcome
Falco 1914	16	Rapidly enlarging abdomen for 1 mo. reaching size of 9-mo. pregnancy; gastrointestinal and urinary disturbances, pain, fever, tumor; ovariotomy; recurrence in 4 mo.; severe abdominal pain, vomiting, anemia, rapidly growing mass; extensive peritoneal metastases at operation	Right	Multilocular cystic and solid; sarcomatous; recurrence more anaplastic	Death 7 mo. from onset
Fasolt 1936	8½	Precocious menstruation for 2 yr.; positive Aschheim-Zondek test		Teratoma with chorio-epithelioma	Death with metastatic chorio-epithelioma
Willis 1936	15	Abdominal enlargement size of 6-mo. pregnancy		Solid and cystic; marked cellularity and mitoses; other ovary with non-malignant teratoma	Death in 2 mo. with abdominal metastases
Dreyfus 1936	12	Three wk. mild and severe symptoms of torsion, tumor, precocious sexual development; ovariotomy; recurrence of symptoms, tumor and metastases in scar in 2 mo.; postoperative radiation	Left	Solid; torsion; all layers with abundant embryonal glia	Death in 2 mo. with recurrence
	5	Enlarging abdomen for 5 mo.; late symptoms of torsion, anemia, tumor reaching hypogastrium; ovariotomy; no visible metastases	Right	Cystic and solid; ectodermal and mesodermal tissues with carcinoma	Postoperative death
	13	Case of Zoltan and Szathmary Inoperable tumor at laparotomy		.....	.....
Meyer 1936	4	Symptomless lower abdominal mass 2½ yr.; ovariotomy; no visible metastases; intestinal obstruction in 6 mo.; inoperable paravertebral mass at operation	Right	All layers represented histologically benign	.....
Mayo and Butsch 1938	8	Right ovarian resection for torsion 6 mo. previously; recurrent symptoms, tumor filling pelvis and lower abdomen	Right	Ectodermal tissues with adenocarcinoma grade 1	Operative recovery
Smeltzer 1938	8	Symptoms of torsion 3 wk., tumor; ovariotomy; no visible metastases postoperative radiation; recurrence of symptoms in 3 mo.; laparotomy 5 mo. later; extensive peritoneal metastases	Right	Solid with torsion; embryonal tissues of all layers; sarcoma	Death 1 yr. after onset
	14	Mild symptoms of torsion 2 wk.; tumor; ovariotomy; mass filling pelvis and lower abdomen; recurrence of symptomless mass in 6 mo.; peritoneal metastases at laparotomy; postoperative radiation	Left	Solid and cystic; embryonal tissues of all layers; histologically benign; metastases of embryonal tissues with many mitoses	Death 14 mo. after onset
Kelly 1940	13	Amputation of leg at 3 yr. for cavernous angioma; recurrences treated with x-ray for 7 yr.; abdominal tumor at 13 yr.; radioresistant; ovariotomy; postoperative radiation; early good results		Large lobulated mass with fibrosarcoma and carcinoma	Death apparently from metastases 9 mo. after onset
McElhinney 1941–1942	14	Symptomless, rapidly growing tumor for 2 mo., weight loss, fever; ovariotomy; mass above umbilicus; postoperative radiation	Right	Cystic and solid; sarcomatous areas	Operative recovery
Mattos et al. 1945	14	Acute torsion; ovariotomy; ovary 3× normal; complicated by congenital anomalies and primary carcinoma of uterus		Ectodermal and mesodermal tissues with sarcomatous areas	Operative death
Authors	7	Acute torsion; resection; no visible metastases; intestinal obstruction in 5 mo.; peritoneal metastases; postoperative radiation	Right	Cystic with torsion; adult and embryonal tissues; histologically benign; metastases more embryonal with mitoses	Well 5 mo. after 2d operation
	19	Increasing signs of torsion; bilateral resection; secondary operation for removal of all genital organs; postoperative radiation	Left	Solid with torsion; adult and embryonal tissues with glioblastomatous areas; opposite ovary with non-malignant teratoma	Well 5 mo. later

have proven benign. A more valuable feature in judging the potentiality of an individual case is the rapidity of growth. A rapidly enlarging tumor has usually proven malignant.

The tissues represented in teratomas are usually derivatives of all three germinal layers although those of ectodermal origin are the most abundant. Glial tissue appears to be a very common component. The case of Mayo and Butsch is the only one with ectodermal tissues only.

Sarcomatous degeneration is more common than carcinomatous, conforming to the recognized incidence in the young of the two types of malignancy. Carcinoma occurring in a teratoma with ectodermal derivatives only, usually seen among older individuals, is represented by the patient of Mayo and Butsch. Sometimes, as in Case 1 and in a few other instances, the tissues appear embryonal only and not malignant although the clinical course with recurrence and metastasis has proven the malignant nature of the growth.

The presenting symptoms have been classified by Steel into four groups, namely, (1) tumor, (2) precocious sexual changes, (3) mechanical effects on surrounding viscera and (4) torsion. By far the most frequent has been the complication of torsion. In many instances it has been intermittent. Occasionally a severe attack initiates the course. Precocious sexual changes have been present, both as the predominant feature or associated with others more prominent. The mechanical effects are usually exerted on the gastrointestinal or urinary systems and consist of diarrhea or constipation and urgency, frequency or difficulty in voiding. Symptomless tumor growth does not appear to be very common.

The prognosis is poor. Few patients live more than one year after the onset of symptoms. Treatment is surgery followed with roentgentherapy. The main features of the more recent cases are summarized in Table 1.

SUMMARY AND CONCLUSIONS

Teratomas of the ovary are infrequent in the first two decades of life. They comprise the most common tumor of the premenstrual years. Approximately 150 authentic cases are found in the literature including those reported as dermoids. About one-third have proven malignant. They have both cystic and solid areas. The rapidity of growth is a more valuable criterion of malignancy than the gross appearance of solid or cystic tumor. Sarcomatous change is more common than carcinomatous change. Some malignant tumors have shown only embryonal tissue not histologically malignant. The most common presenting symptoms are due to torsion. Pressure effects on neighboring organs, precocious sexual changes and symptomless tumor growth are less common. They tend to recur and metastasize early. The prognosis is poor. Therapy is radical surgery followed with roentgentherapy.

Addendum: The first patient, Case 1, subsequently died with extensive metastases. The second patient appeared in perfect health and free of any evidence of malignancy twenty-one months after operation.

REFERENCES

1. Matthews, F. S. Management of bilateral ovarian dermoids. *Ann. Surg.*, 82: 483–485, 1925.
2. Pollack, Quoted by Lanman, T. H. Ovarian tumors in childhood. *New England J. Med.*, 201: 555–562, 1929.
3. Steel, W. A. Torsion of ovarian cyst in children. *Brit. J. Med.*, 2: 798–800, 1931.
4. Goodfriend, M. J. and Caruso, L. J. Ovarian malignancy in a young girl. *New York State J. Med.*, 49: 2178–2180, 1949.
5. Doran, A. H. G. Clinical and Pathological Observations on Tumours of the Ovary, Fallopian Tubes anc Broad Ligament, chap. 5. London, 1884. Smith Elder & Co.
6. Sutton, J. B. Surgical Diseases of the Ovaries and Fallopian Tubes, chap. 8, pp. 83–110. London, 1891. Cassell.
7. Weil, H. I. A survey of ovariotomy at extremes of life. *Bull. Jobns Hopkins Hosp.*, 16: 102–109, 1905.
8. Frank, R. F. A case of malignant teratoma of the ovary. *Am. J. Obst.*, 55: 348–375, 1907.
9. Harris, R. H. Carcinomatous ovarian teratoma with premature puberty and precocious somatic development. *Surg., Gynec. & Obst.*, 24: 604–611, 1917; 41: 191–193, 1925.
10. Loeb, M. J. and Levy, W. Ovarian cysts and tumors in children under ten years of age. *Arcb. Pediat.*, 49: 651–666, 1932.
11. Wakely, C. P. G. Ovarian teratomatous cysts occurring in children. *Surg., Gynec. & Obst.*, 56: 692–695, 1933.
12. Witzberger, C. M. and Agerty, H. A. Ovarian tumors in infancy and childhood. *Arcb. Pediat.*, 54: 339–348, 1937.
13. Baccarini, L. Contributo allo studio dei teratomi ovarici nell'infancia. *Arcb. ital. di cbir.*, 36: 161–172, 1934.
14. Willis, R. A. Structure of teratomata. *J. Patb. & Bact.*, 40: 1–36, 1935; The histogenesis of neural tissue in teratomata. *J. Patb. & Bact.*, 42: 411–416, 1936; A further study of the structure

of teratomata. *J. Path. & Bact.*, 45: 49–65, 1937; Pathology of Tumours, chap. 61, pp. 940–984. St. Louis, 1948. C. V. Mosby.
15. Meyer, F. W. Teratoma of the ovary with malignant metastases in childhood. *J. Phillippine Islands M. A.*, 16: 555–559, 1936.
16. Dreyfus, J. R. Les teratomes de l'ovaire et l'action endocrine des tumeurs de l'ovaire chez les enfants. *Arch. de med. des Enfants*, 39: 719–723, 1936.
17. Searby, J. J. Teratoma of the ovary in a child. *M. J. Australia*, 24: 922–923, 1937.
18. Mayo, C. W. and Butsch, W. L. Ovarian tumors among young girls. *Minnesota Med.*, 21: 256–258, 1938.
19. Kelly, J. A. In: Dargeon, H. W. Cancer in Childhood. Gynecological cancer in children, pp. 58–66. St. Louis, 1940. C. V. Mosby.
20. Smeltzer, M. Solid teratoma of the ovary in the young girl. *Am. J. Obst. & Gynec.*, 41: 616–623, 1941.
21. McElhinney, W. T. Solid teratoma of the ovary in a fourteen year old girl. *Cincinnati J. Med.*, 22: 194–195, 1941–1942.
22. Mattos, S. A., Ferraira, J. and Viana, D. Teratoma complicado na infancia. *An. brasil. de ginec.*, 20: 177–188, 1945.
23. Falco, A. Sul teratoma solido dell'ovario. *Ann. di ostet. e ginec.*, 36: 394–440, 1914.
24. Fasolt, H. Ein teratom des ovars mit chorioepitheliomähnlichen metastasen. *Ztschr. f. Kinderh*, 51: 319–334, 1931.
25. Downes, W. A. Tumors of the ovary in children. *J. A. M. A.*, 76: 443–445, 1921.

Some patients with amebic dysentery, even when put on intensive antiamebic therapy, may fail to heal completely and are then often left with a disabling condition not unlike non-specific ulcerative colitis. In such instances frequent proctosigmoidoscopic examinations and appropriate treatments are needed for the residual ulcerative lesions in the colon. To fail to do so, and simply relying instead upon a long continued antiamebic regimen, often results in "uncured" cases. In short, one should not continue to use amebacides when the ameba no longer are found in the stools in patients with persistent symptoms. Such patients now need different treatment for their unhealed ulcerative lesions. Aureomycin seems very useful for these complications. (*Richard A. Leonardo, M.D.*)

SURGICAL TREATMENT OF ELEPHANTIASIS OF THE LOWER EXTREMITY

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ELEPHANTIASIS is generally recognized as the end result of chronic lymphatic obstruction regardless of the cause of such obstruction. Involvement of an entire lower extremity may become extensive enough to produce recurrent cellulitis, embarrassing disfigurement as well as serious physical handicap to the patient. In treating such patients we believe that more emphasis should be placed upon a radical surgical approach.

Investigation of the anatomy of lower extremity lymphatics and the pathogenesis of elephantiasis by Homans et al.[1] and Reichert[2] definitely establish the rationale of the operation described by Kondoleon[3] ten years previously. The technic of this procedure has been advanced by Sistrunk[4] and Poth.[5] Since lymphatic obstruction must be reduced, the technic involves excision of the skin, superficial and deep fascia of the leg down to the muscle fibers.

Just as chemotherapeutic drugs aid in preventing the infectious insults which invariably result in a progression of this disease, so do they aid the healing processes which are necessary for satisfactory end results. Moreover, we believe that a period of physiotherapy in the nature of supervised exercises and massage is indicated at the proper stage of convalescence. If surgical excision of the lymphedematous tissue is combined with chemotherapy and followed by a program of physical therapy, excellent after-effects will be obtained. The case herein presented demonstrates the efficacy of this combined therapy.

CASE REPORT

Mrs. O. S., a thirty-two year old stenographer, was seen first in August, 1947, with the complaint of a markedly swollen and persistently painful extremity. She suffered considerable disability and embarrassment because of its size and weight. (Figs. 1 and 2.)

The essential incidents in her past history included an attack of appendicitis in 1931 which necessitated an appendectomy. The postoperative period was complicated by a separation of the wound. In 1936 she noted painless swelling in the medial portion of the left ankle. The swelling slowly progressed upward. In 1939 she was bedfast for six weeks because of a "blood clot" in the left leg which was accompanied with pain and swelling in the affected limb with fever rising to 105°F. on several days. By 1940 the swelling had progressed to the groin. During the next four years she had a series of three abdominal operations, all for recurrent pain in both lower quadrants, menstrual irregularities and severe dysmenorrhea. Shortly before the second of these operations she noted a swelling in the right thigh and ankle, but this disappeared after the surgical procedure. Following this operation she was told that a portion of the small intestine was resected and that both ovaries were completely removed. Abdominal symptoms did not recur after the last procedure and her health was excellent except for the symptoms referable to the left leg and thigh.

Physical examination revealed a well developed and well nourished woman. Her heart, lungs and abdomen were normal. Systolic blood pressure was 150; diastolic, 100. On pelvic examination a normal cervix was found, but the fundus and ovaries were not palpable. Massive swelling of the left leg was present. There were no ulcers or abnormal pigmentation noted on the surface of this huge lower extremity. The skin pitted easily and painlessly. Several superficial fissures were present around the ankle. Edema extended from the toes to the groin. Good peripheral pulsations were present. Laboratory findings were normal.

The first operation on this extremity was the classic Kondoleon procedure. The tissue which was removed weighed 30 pounds. Primary

1 2

FIG. 1. Preoperative photograph showing patient's lymphedematous left lower extremity.
FIG. 2. Photograph taken one year after operation.

closure of the wound was accomplished. The patient's convalescence was uncomplicated.

Four months after operation, however, the left leg and thigh were practically the same dimensions as they were on initial admission. The patient was still uncomfortable. In September, 1948, the patient was readmitted to the hospital and the following operation was performed (Fig. 3):

The right thigh and lower abdomen were prepared with soap, ether and alcohol. Split-thickness skin grafts, aggregating 230 square inches, were excised from the prepared area with a Blair Brown skin knife. The grafts were placed with the epidermal surface down upon a perforated cellophane pattern of dimensions estimated adequate to cover the patient's superficially denuded leg with skin. Gauze moistened with saline was placed over the excised tissue. The donor area was dressed with scarlet red gauze, and a pressure dressing was applied.

The lymphedematous lower left extremity was prepared and draped from the groin to and including the plantar surface of the foot. A circular incision was made around the leg at the level of the tibial tuberosity. The incision was carried down through the deep fascial compartments of the leg to the muscle. The peroneal nerve was visualized and protected. A longitudinal incision of the same depth was carried along the fibular surface of the leg to a point 2 cm. distal to the thinly covered malleolus of the fibula. The incision was then extended in a circular fashion around the foot from below the lateral malleolus along the fifth metatarsal shaft and the base of the toes then posteriorly to a point 3 cm. distal to the malleolus of the tibia. The extremities of the incision were united upward in a horseshoe manner to preserve a padded area over the Achilles bursa. The skin, boggy superficial and deep fascia of the leg were excised *en bloc*. The deep fascia comprising the inter-

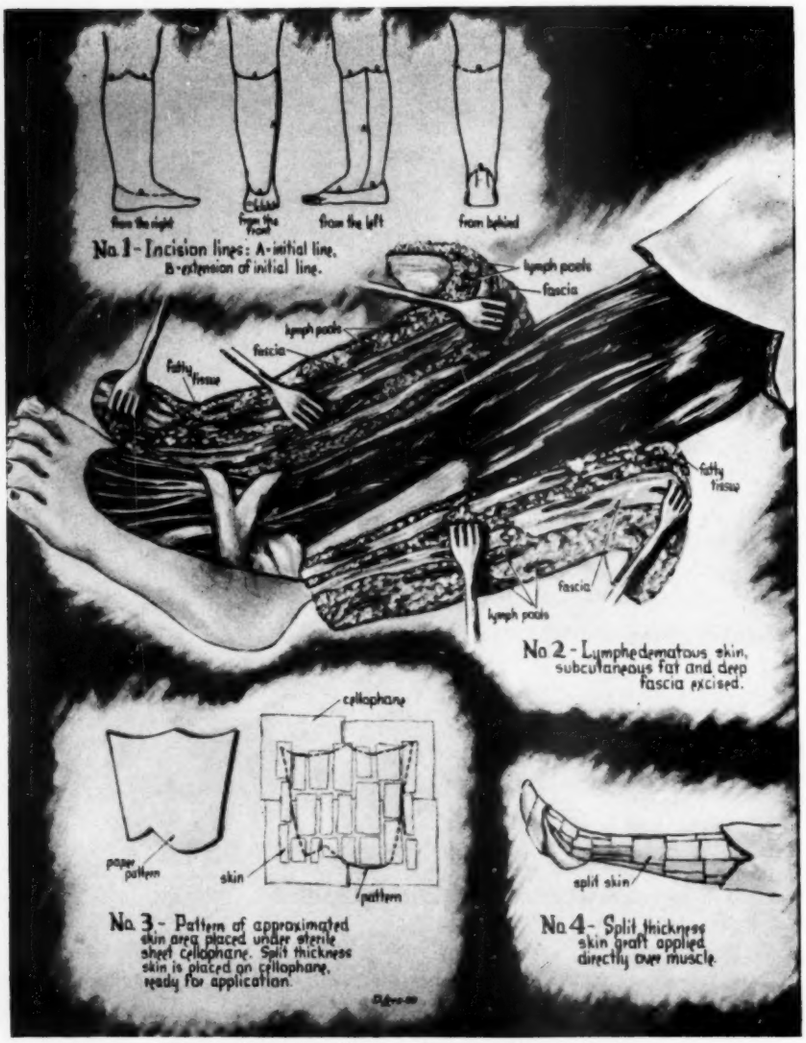
from the right
from the front
from the left
from behind
No. 1 - Incision lines: A-initial line, B-extension of initial line.
lymph pools
fascia
fatty tissue
No. 2 - Lymphedematous skin, subcutaneous fat and deep fascia excised.
cellophane
paper pattern
skin
pattern
No. 3 - Pattern of approximated skin area placed under sterile sheet cellophane. Split thickness skin is placed on cellophane, ready for application.
split skin
No. 4 - Split thickness skin graft applied directly over muscle.

FIG. 3. Drawing illustrating operative technic.

muscular septa of the leg was excised only 1 cm. beneath the surface of the muscle in order to preserve anatomic configuration. Hot moist packs were placed on the oozing surface. After their removal the split skin grafts were applied over the denuded areas. It was unnecessary to suture any of the grafts. At the completion of the operation scarlet red gauze and pressure dressings were applied to the leg. The foot was fixed in dorsiflexion. Blood lost during the operation was replaced by continuous transfusion. Massive doses of penicillin and streptomycin were administered throughout most of the hospital period.

The dressing was changed on the seventh postoperative day. Two weeks after the operation the patient began graduated exercises to improve circulation, muscle tone and function of the operated extremity. Daily "whirlpool" baths were used. Exercise was gradually increased to include walking, swimming and dancing. This physical therapy was very beneficial and played an important part in restoring normal function. At the present time the patient has excellent use of this previously disabled extremity without discomfort.

SUMMARY

It is our opinion that marked lower extremity elephantiasis, as manifested in the case herein reported, demands surgical excision of lymphedematous tissue with chemotherapy and followed by physiotherapy. A single procedure with immediate skin grafting as successfully

used in this case is recommended for further consideration and comment.

REFERENCES

1. Homans, J., Drinker, N. and Field, C. F. Elephantiasis and the clinical implication of its experimental reproduction in animals. *Ann. Surg.*, 100: 812, 1934.
2. Reichert, F. S. The regeneration of lymphatics. *Arch. Surg.*, 13: 871, 1926.
3. Kondoleon, E. Die Operative Behandlung der Elephantiastischen Odene. *Zentralbl. f. Chir.*, 39: 1022, 1912.
4. Sistrunk, W. E. Contributions of plastic surgery. *Ann. Surg.*, 85: 185, 1927.
5. Poth, E. J., Barnes, S. R. and Ross, G. T. New operative treatment for elephantiasis. *Surg., Gynec. & Obst.*, 84: 642, 1947.

Because estrogens have a favorable effect on patients with prostatic cancer, it was thought worth while to study the metabolic results of the administration of natural estrogens on these patients and to compare these results with those occurring in controls (normal patients). Experiments showed that patients with cancer of the prostrate could more readily convert exogenous estrone into estriol but no other definite results could be ascertained. The procedure adopted was a fractionation and photometric estimation of the amount of estrone, estradiol and estriol in the urine of patients receiving single therapeutic doses of the natural estrogens. Apparently, the presence of castration has no bearing whatsoever since these patients excreted virtually as much total estrogens as did the normal controls. While the results of these experiments on the metabolism of estrogens are interesting, they are of no value as diagnostic or prognostic tests in patients with prostatic malignancy. (*Richard A. Leonardo, M.D.*)

PSEUDOCYST OF THE PYLORUS AND DUODENUM*

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IT is customary for a case report to begin with emphasis on the rarity of the condition and a review of the literature on the subject. This usual introduction cannot be used in this case since no report of a similar condition can be found in the literature.

CASE REPORT

B. B., a four year old white boy, entered the Children's Memorial Hospital August 13, 1948, with the history of anorexia and vomiting for ten days. The vomiting occurred shortly after eating or drinking and was increasing in severity. No bile or blood had been noted in the vomitus. For six days prior to admission he had had no bowel movement, but an enema produced a small amount of hard, black stool. There was no history of trauma or of previous similar attacks.

The patient was a well nourished and well hydrated boy lying listless but in no apparent discomfort. The abdomen was quite soft and "doughy"; otherwise the physical examination was entirely negative. The rectal temperature was 100.2°F.

The blood count and urinalyses were normal. Serology was negative. The sedimentation rate was 7 mm. per hour. Blood chemistries were within normal limits except for the total proteins which were 5.1 mg. per cent with a normal albumin-globulin ratio.

The child continued to vomit almost everything taken by mouth, often with projectile force. The vomiting contained no bile and only a trace of occult blood. The child remained quite apathetic and ran an irregular fever at times reaching 102° to 103°F. Fluids were administered parenterally in adequate amounts.

On the fifth hospital day peristaltic waves were noted passing across the upper abdomen and a small, indistinct mass was felt in the right upper quadrant. During the next few days this mass became larger and more distinct but remained soft and non-tender.

FIG. 1. Opened duodenum and pylorus showing cavity in medial wall.

X-rays taken after a barium meal showed 80 per cent retention in the stomach after three hours. A more detailed examination under the fluoroscope two days later showed complete obstruction at the pylorus with 100 per cent retention of barium in the stomach after five hours.

At operation the abdomen was explored through a right paramedian incision extending from the xyphoid to the umbilicus. There was a small amount of turbid yellow fluid free in the abdominal cavity.

The pylorus and first portion of the duodenum were enlarged into a cystic mass 5 inches long and 2 inches in diameter. The head of the pancreas was densely adherent to this mass. There were fine adhesions about the tumor, gall-

* From The Children's Memorial Hospital, Chicago, Ill.

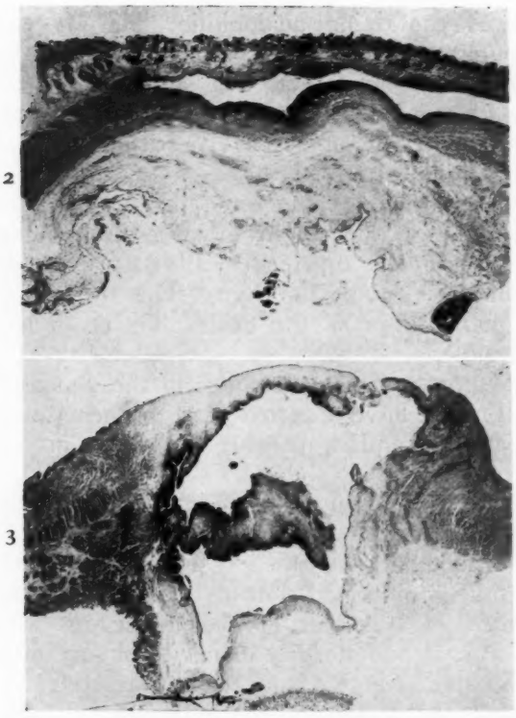

FIG. 2. Microscopic section at duodenal end of cavity; the "cyst" has no wall of its own and is submucosal.
FIG. 3. Microscopic section at the pyloric end of the cavity showing the disrupted muscle fibers and the extension to the serosa.

FIG. 4. Photograph of B. B., one year postoperatively, indicates the excellent nutrition and good health.

bladder, stomach and colon. A yellow, gelatinous material with scattered white particles resembling cottage cheese lay about the tumor and the head of the pancreas. The common bile duct was found to enter the lower posterior aspect of the tumor mass. On the anterior surface of the stomach just at the pylorus the serosa was paper thin and fluid could be seen immediately beneath it. Aspiration yielded 10 cc. of blood-tinged fluid.

The true nature of the lesion could not be determined but certain facts seemed evident. The mass had enlarged until it now completely occluded the pylorus and duodenum. Perforation through the serosa near the pylorus seemed imminent with the probability of duodenal fistula formation.

The enlarging mass seemed about to occlude the common bile duct. The appearance of possible fat necrosis suggested that the pancreas must be involved in some degree. The child was in excellent condition. Considering all these factors it was decided that removal of the mass was the procedure of choice.

The involved duodenum, pylorus and antral portion of the stomach along with the densely adherent upper corner of the head of the pancreas were removed. No major duct could be made out on the cut surface of the pancreas which was closed with interrupted catgut sutures.

The duodenal stump was closed and 2 cm. below this an end-to-side anastomosis of the common bile duct to the duodenum was performed. An antecolic anastomosis was made between the remainder of the stomach and the jejunum 20 cm. from the ligament of Treitz. The wound was closed with drainage.

The fluid aspirated at operation showed no growth on culture. In the anterior and medial wall of the duodenum and pylorus there was a large cavity filled with old blood clots and serous fluid. (Fig. 1.) At the duodenal end the cavity lay under the mucosa. (Fig. 2.) It then burrowed up through the pyloric muscle fibers to lie under the serosa at the gastric end of the specimen. (Fig. 3.)

Gross examination revealed no clue as to the cause of the condition. Microscopic examination showed that the cavity had a mild, nonspecific inflammatory reaction in its walls, with

some deposits of hemosiderin pigment. There were a few pieces of amorphous hyalin material in the lumen of the cavity. The pancreas appeared normal and no sizable ducts were found.

The postoperative course was completely smooth. The child has been observed for more than a year and is in excellent health. (Fig. 4.) There has been no fever or jaundice. On a normal diet at home the child developed mild steatorrhea which is entirely controlled by oral dosage of pancreatin. There is marked keloid formation in the abdominal scar.

COMMENTS

Consultation with several pathologists gives no definite answer as to the exact etiology of this condition. The literature is equally unenlightening. The following possibilities were entertained:

Enterogenous cysts (intestinal duplications) occur in the duodenum.[1–3] The most important characteristic of these cysts is that they have their own complete wall of mucosa and muscularis. Even if pressure causes erosion of the mucosa, there is always a muscular lining. In this case, however, the cavity had no lining of its own and extended through the pyloric muscle fibers in a manner that no true cyst could do.

A cyst of the ampulla of Vater has been reported[4] but was in no way similar to this case, one of the differential points being the absence of jaundice.

Booher and Pack[5] reviewed the subject of cyst of Brunner's glands. These cysts lie just under the mucosa of the duodenum and are thought to result from degeneration of adenomas of Brunner's glands. They consist of multiple small cysts each no more than a few millimeters in diameter containing mucoid material and remnants of ducts and glandular epithelium. This condition bears little resemblance to the one in question.

Aberrant pancreatic tissue may lie within the duodenal wall. Norris[6] reports a submucosal duodenal tumor measuring 2 by 1.5 cm. found at necropsy. Microscopic sections revealed it to be pancreatic tissue surrounded by large spaces containing acidophilic fluid. It was thought that this might represent pancreatic juice. Is it possible that a submucosal pancreatic rest could undergo necrosis and autodigestion ending up as a cavity with no trace of the original cause?

One pathologist suggested that a tiny mucosal perforation might have resulted in an abscess in the duodenal wall that "burned itself out" leaving the cavity. This theory has as many flaws as the others but is no less plausible.

A spontaneous hemorrhage in the duodenal wall might have occurred with the hematoma expanding and burrowing its way in all directions.

All of the speculations are interesting but do not seem to lead us to the exact nature of this condition. All one can say is that a cavity containing old blood clots and serous fluid had formed in the wall of the duodenum and pylorus. It had steadily increased in size until it became palpable and then completely occluded the lumen of the intestine. Further enlargement threatened to allow rupture at the pylorus or occlude the common bile duct.

SUMMARY

1. A case of cyst-like cavity in the walls of the duodenum and pylorus is presented and discussed.

2. Review of the literature sheds no light on the nature of this condition and no report of a similar case can be found.

REFERENCES

1. Pachman, D. J. Intramural cysts of the intestine. *Am. J. Dis. Child.*, 58: 485, 1939.
2. Shallow, T. A., Wagner, F. B. and Manges, W. B. Enterogenous cysts of the duodenum. *Surgery*, 21: 532, 1947.
3. Hicken, N. F., Stevenson, V. L., Carlquist, J. H. and Coray, Q. B. Multiple duplicative cysts of the duodenum causing intestinal obstruction. *Am. J. Surg.*, 76: 92, 1948.
4. Brooks, B. and Weinstein, A. Cyst of the ampulla of Vater, *Ann. Surg.*, 117: 728, 1943.
5. Booker, R. J. and Pack, G. T. Cysts of the duodenum. *Arch. Surg.*, 53: 588, 1946.
6. Norris, J. C. Aberrant pancreas in the duodenum. *South. M. J.*, 39: 549, 1946.

GELATINOUS ADENOCARCINOMA OF THE CERVIX UTERI

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GELATINOUS adenocarcinoma of the cervix uteri is a rare entity. In reviewing the literature only sixteen cases have been reported and all of these are in the foreign literature. We are reporting one case and reviewing five cases from the literature.

CASE REPORT

Our patient was a forty-five year old white female who was first seen on January 22, 1948. At that time she complained of menorrhagia, metrorrhagia and leukorrhea of one year's duration. She stated that she had felt tired and had noted increased urinary frequency. Her past history was not remarkable except for an appendectomy in 1945 and three uneventful pregnancies. There was no family history of malignancy.

General physical examination was essentially normal except for obesity. Pelvic examination revealed the uterus to be small, firm and movable; adnexal areas were clear with no parametrial induration or fixation. The cervix was large and soft. On speculum examination the whole area of the portio vaginalis and external os was involved by a gelatinous new growth. There was no extension onto the vagina.

On January 23, 1948, a dilatation and curettage and biopsy of the cervix was done. At the same time 100 mg. of radium in a T applicator was inserted into the cervical canal and against the cervix for forty-eight hours. This was followed with deep x-ray therapy.

The pathologic report of the biopsy was as follows: Sections revealed an anaplastic adenomatous new growth with marked mucus production. The epithelial cells were differentiated as mucus-producing cells and were high columnar in type. They formed the lining of cyst-like spaces or large dilated glands. Segments of epithelium were exfoliated into the mucus-filled cysts. There was a diagnosis of gelatinous adenocarcinoma of the cervix uteri.

Since we realized that this type of tumor would not be very sensitive to irradiation therapy, the patient was readmitted eight weeks later (March 18, 1948) and a radical hysterectomy was performed. Careful exploration of the abdomen did not reveal any lesion outside the pelvis. The uterus was found to be slightly enlarged and the ovaries markedly sclerotic. There was no evidence of parametrial or lymph node involvement.

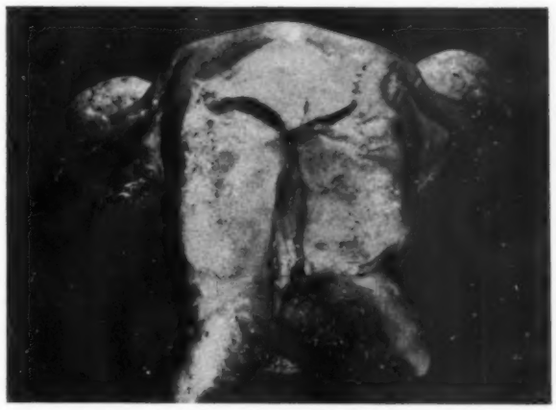

FIG. 1. Uterus with cervix and adnexa; the cervix is extensively involved by a polypoid-like mass extending from the portio throughout the cervical canal. The specimen has been trimmed for photography.

Macroscopic description was as follows: The uterus measured 10.5 by 6.5 by 4 cm. The portio of the cervix and endocervix were extensively involved by a gelatinous mass which invaded about one-half the thickness of the cervical wall and extended throughout the cervical canal. (Fig. 1.)

Microscopically, sections of the cervix uteri revealed a dense inflammatory reaction of the mucous membrane. The infiltrating cells were mostly plasma cells and lymphocytes. There were also large cyst-like spaces filled with mucus. These areas differed from the original biopsy in that the malignant epithelial cells had been mostly eliminated. Giant cells frequently surrounded the mucus. The cuff of vagina removed was free from any extension of the growth. A mass of areolar tissue with iliac glands showed no involvement.

Microscopic diagnosis was as follows: (1) gelatinous adenocarcinoma of the cervix uteri

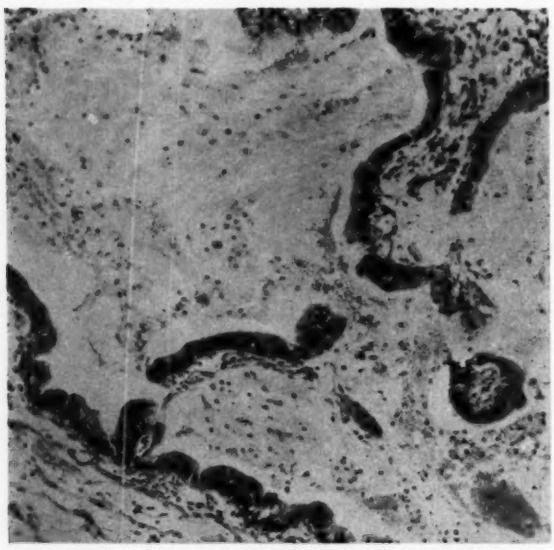

FIG. 2. Photomicrograph of cervical neoplasm (biopsy specimen) and revealing cyst-like spaces filled with mucus; the lining cells are high columnar and mucus secreting.

exhibited marked irradiation effect, (2) atrophic endometrium, (3) normal myometrium, (4) normal fallopian tubes, (5) sclerotic ovaries. (Fig. 2.)

The patient made an uneventful recovery and was discharged home on the eighth postoperative day. Thus far there is no evidence of recurrence of the malignancy.

COMMENTS

To our knowledge no case of this type has been reported in the American literature. We were able to obtain translations of four articles from the foreign literature reporting five cases of gelatinous adenocarcinoma of the uterine cervix. Abstracts of these papers follow:

Tilmann reported a forty-nine year old Para VII whose menses were normal until three months prior to admission when she had severe abdominal pain at the onset of her menstrual period following which she had amenorrhea. She began to spot two weeks prior to admission. The pelvic examination revealed a mushroom-like growth on the posterior lip of the cervix. The cervical canal was patulous and the entire uterus was a sloughing cavity. The parametria were free, but there was a tender mass in the cul-de-sac. A biopsy was taken which was reported as carcinoma of cylindroma type with gelatinous areas. She was given deep x-ray therapy followed in two and eight months with radium. She expired sixteen months after she was first seen. Autopsy revealed gelatinous carcinoma of the cervix with metastasis to the vagina, urinary bladder, pelvic connective tissue, lungs and pericardium.

Richter reported two cases. The first was that of a woman near the menopause who had vaginal bleeding for several years. When first seen the uterus extended to 3 cm. below the umbilicus and the vagina was extensively infiltrated. A biopsy was taken and reported as gelatinous adenocarcinoma of the cervix. Radium was inserted and the uterus shrank to a size where surgery was considered feasible, but the patient refused surgery and slowly died.

The second case was that of a forty-two year old woman who had a pelvic abscess when first seen. A month later a diagnosis of gelatinous carcinoma of the cervix was made and a Wertheim type hysterectomy was done. She died of recurrence four years later.

D'Arrigo described the microscopic pathologic features of a gelatinous adenocarcinoma of the cervix in a fifty-four year old woman. He supports the view that this tumor is a pathologic entity and not a manifestation of degeneration. He gave no history or treatment of his patient.

Silva reported the case of a thirty-one year old female who complained of spotting following sexual intercourse. On examination the cervix was found to be a large cauliflower-like mass of dense mucous appearance. The vagina and parametria were free of infiltration. The uterine corpus was of normal size. A total hysterectomy with bilateral adnexectomy, following the technic of Freund, was done. She made an uneventful recovery.

We regard gelatinous adenocarcinoma of the cervix uteri as a mucus-producing variant of adenocarcinoma occurring in this anatomic location. All adenocarcinomas of the cervix uteri are fundamentally endowed with ability to produce some mucus. However, such excessive elaboration of mucus does not often accompany the development of adenocarcinoma except in the gastrointestinal tract and mammary gland in which it is quite commonly observed. It is probable that here, as in the gastrointestinal tract, the mucus production is an expression of excessive mucus gland activity and not a mucinous degeneration. Perhaps a more appropriate designation for this neoplasm would be

mucinous adenocarcinoma. It should be expected, from knowledge of the histogenesis of neoplasm, that the clinical behavior would be similar to other adenocarcinomas in this location.

SUMMARY

A case of gelatinous adenocarcinoma of the cervix uteri is presented and five similar cases from the literature are abstracted in this paper.

REFERENCES

1. D'Arrigo, Salvator. Un caso di cancro gelatinosa dell'utero. *Patbologica*, 34: 159–162, 1942.
2. Richter, C. S. Twee gevallen van carcinoma gelatinosum der portio vaginalis uteri. *Geneesk. tijdscbr. v. Nederl.-Indië*, 70: 1117–1120, 1930.
3. Silva, Camillo. Su di un caso di carcinoma gelatinosa del collo dell'utero. *Ann. ostet. e ginec.*, 60: 1604–1615, 1938.
4. Tilmann, Otto. Über den Schleimkrebs des Collum uteri. *Zentralbl. f. Gynäk.*, 58: 2779–2786, 1934.

Eosinophilic granulomas were first described in 1940 and it is now known that they occur especially in male children; and if multiple lesions exist, they usually involve the ribs or skull and then the other bones. X-rays of the involved bones present a distinct, punched out appearance and occasionally one also encounters a pathologic fracture. Gross appearance of the lesion shows yellowish tissue spotted with hemorrhagic necrotic areas. The whole surface has a soft feeling. Histologically, large masses of eosinophiles are seen together with multinuclear histiocytes and phagocytic mononuclear cells. Usually, excision of the involved area suffices for a cure. (*Richard A. Leonardo, M.D.*)

New Instruments

APPARATUS FOR INTRA-ARTERIAL TRANSFUSION*

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IN the treatment of shock from any cause the administration of whole blood by the intra-arterial route may be a life-saving procedure. Despite the general recognition of the value of intra-arterial transfusions this procedure has not received the wide-scale use which it merits. One reason for this may be that the majority of the apparatus previously described are too complicated for general use. In an attempt to simplify the administration of whole blood by the intra-arterial route an apparatus† has been designed by one of us (A. V. Z.) which is herein described.

† Manufactured by the Foregger Company, Inc., New York, N. Y. Exhibited at the Annual Meeting of the American Society of Anesthesiologists, Inc., December 1949, New York, N. Y.

The component parts of this apparatus are five in number. (Fig. 1.) The parts assembled and ready for use are shown in Figure 2 and are diagrammatically represented in Figure 3.

A commercial oxygen tank (Fig. 3A) is used as the source of pressure. The tank pressure is regulated by a control valve (B) through which the oxygen flows. The oxygen is conducted through a segment of heavy rubber tubing (C) to a hollow metal chamber (D) and then through a threaded metal tube (E) which is enclosed in a mercury-filled cylinder (F). The pressure of oxygen that is necessary to displace a given column of mercury is recorded on an aneroid manometer (G). From the hollow metal

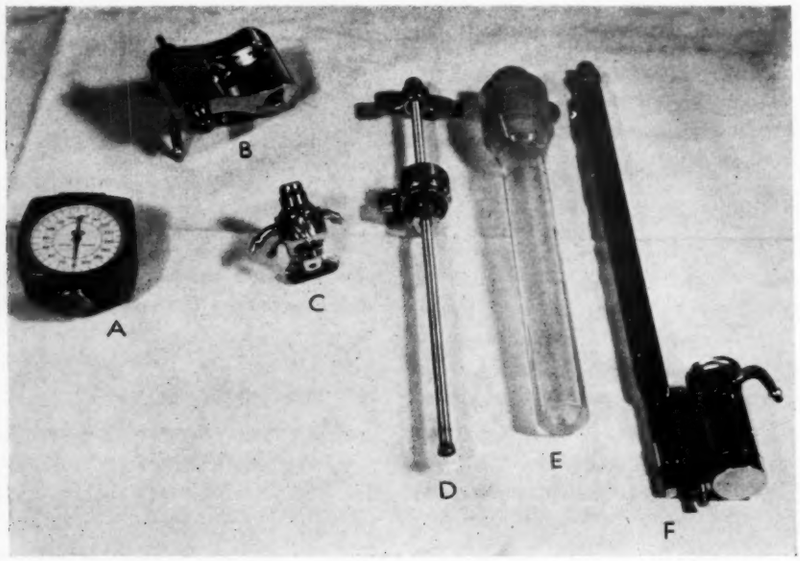

FIG. 1. The component parts of the apparatus are shown. A, aneroid manometer; B, hollow metal chamber; C, three-way stopcock (no longer used); D, threaded metal tube; E, mercury-filled cylinder; F, water manometer. (See Figure 3.)

* From the Department of Obstetrics and Gynecology and the Department of Surgery, St. Clare's Hospital, New York, N. Y.

chamber the oxygen flows through a short length of plastic tubing (H) to a blood-containing flask* (I). The outlet of this flask is connected to the artery of the patient by a sterile needle and a segment of sterile plastic tubing (J). By rotation of the mercury-filled cylinder up or down on the threaded tube the oxygen pressure is respectively increased or decreased. This pressure is maintained at a constant level by a safety "blow-off" valve (K). Compression of the spring lock (L) which is located at the top of the mercury-filled cylinder permits the rapid movement of this cylinder up or down on the threaded tube. In this manner the pressure within the blood-containing flask may be changed quickly with a corresponding change in the rate of blood flow. A detachable water manometer (M) is incorporated for the determination of the venous pressure when desired.

The apparatus when assembled and ready to use is a light, compact, mobile unit that may be connected quickly with a blood-containing flask. This flask has a screw cap in which there are two openings. One of the openings is an air vent that is joined to the hollow metal chamber (D) by a segment of sterile plastic tubing. Through this opening oxygen under pressure is perfused through the blood. As the oxygen bubbles through the blood, foam formation occurs but this has not proved troublesome. The other opening in the cap is for the egress of blood and is connected to the transfusion needle by a length of sterile plastic tubing. If desired two bottles of blood may be arranged in series by the use of a glass or plastic Y connection. (Fig. 4.) With the artery† exposed a sterile No. 15 or No. 17 gauge cannula or Lindemann needle is inserted into the lumen with the point directed toward the heart. By opening the control valve on the oxygen tank the oxygen under pressure is conducted to the blood-containing flask. The pressure within the flask is regulated by rotation of the mercury-filled cylinder. On rotation of the cylinder upward (clockwise) a column of mercury is displaced with a concomitant increase in the oxygen pressure. Contrariwise, on rotation of the cylinder downward (counter-clockwise) there is a decrease in the oxygen pressure. By the regulation of the pressure of oxygen within the blood-containing flask the rate of blood flow is controlled. In general the rate of flow varies in direct proportion to the pressure of oxygen used. In patients in whom the systolic blood pressure is unusually low the blood may be administered in a continuous stream. However, not infrequently difficulty is encountered in the administration of the blood in a continuous stream. This occurs despite progressive elevations in the pressure of oxygen used and may be due to an intrinsic arterial spasm. The arterial spasm may or may not be relieved by the peri-arterial injection of procaine (2 per cent). When the blood flow is in drops, the rate may be so regulated that a drop occurs only in diastole. When this obtains, if the blood-containing flask is lowered to the heart level, the pressure recorded on the ameroid manometer is a direct measure of the intra-arterial systolic pressure of the patient.

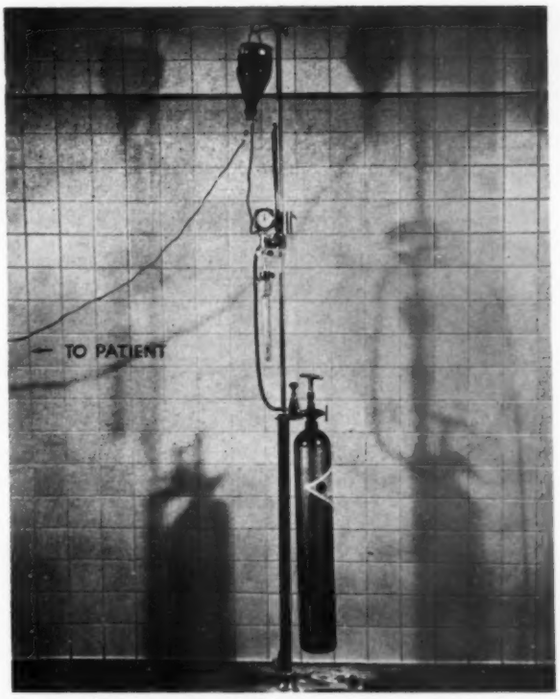

FIG. 2. Photograph of the apparatus assembled and ready for use.

The detachable water manometer that is incorporated in the apparatus is used for the determination of the venous pressure. This determination may be of particular value in patients in whom the cardiac reserve is

* Supplied through the courtesy of Abbott Laboratories, Chicago, Ill.

† The radial artery is preferred; however, any artery readily available may be used.

diminished. In this group a too rapid or excessive intra-arterial blood replacement should be avoided. A sudden elevation of the venous pressure during the transfusion would be an indication either to decrease the rate of flow or stop the transfusion and permit a return of the venous pressure to normal. Subsequent blood replacement should be governed by the particular needs of the patient and the response of the venous pressure to the volume of blood that is administered. In this manner the normal cardiovascular hemodynamics may be maintained on a physiologic basis and the danger of overburdening the heart is minimized.

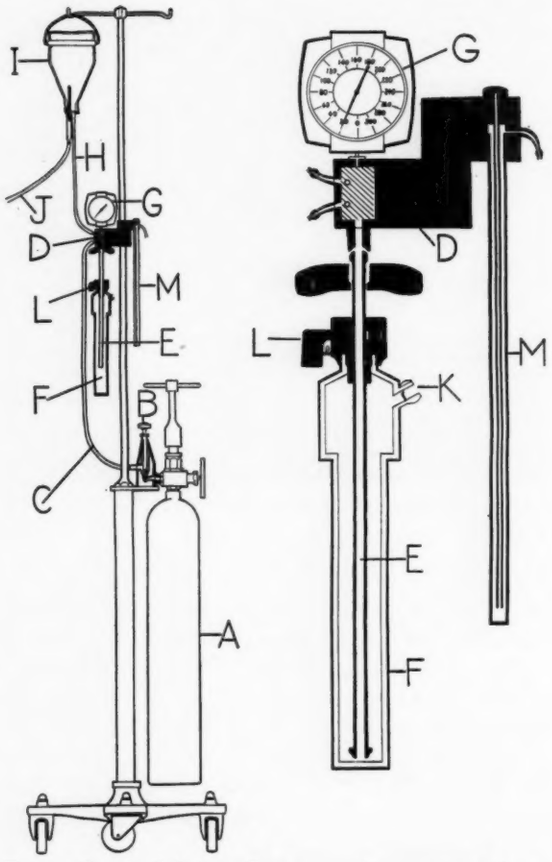

FIG. 3. On the left is a diagrammatic representation of the apparatus assembled and ready for use. A, commercial oxygen tank; B, control valve; C, heavy rubber tubing; D, hollow metal chamber; E, threaded metal tube; F, mercury-filled cylinder; G, aneroid manometer; H, plastic tubing; I, blood-containing flask; J, sterile plastic infusion tubing; K, safety "blow-off" valve; L, spring lock; M, water manometer. This manometer is a modification of that shown in Figures 1 and 2. On the right an enlarged diagrammatic sketch of the assembled parts of the apparatus is depicted.

In several patients on whom prolonged operations were performed the occurrence of shock was anticipated and an artery rather than the conventional use of a vein was selected for the routine administration of blood. In these patients it was observed that the amount of blood required for both the prevention and the control of shock was less than when the intravenous route was used. In employing the intra-arterial drip any sudden fall in intra-arterial systolic pressure may be combated immediately by increasing the rate of blood flow. Accordingly the more frequent use of the prophylactic intra-arterial drip is recommended.

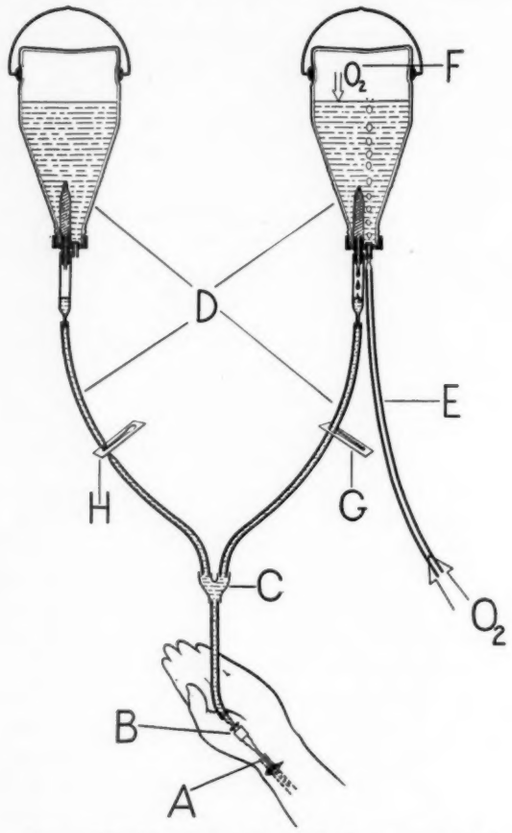

FIG. 4. The blood-containing flasks are arranged in series, which permits a rapid replacement of large quantities of blood. A, radial artery; B, arterial cannula; C, glass or plastic Y connection; D, blood donor sets; E, oxygen conducting tube; F, oxygen pressure layer; G, "pinch" clamp open; transfusion in progress; H, "pinch" clamp closed; blood in reserve.

Upon completion of the transfusion sacrifice of the artery by ligation is not necessary. Digital compression of the artery is usually sufficient to control hemorrhage. If there should be a large opening in the artery, this may be closed satisfactorily with several interrupted

sutures of No. 5-0 silk (Deknatel) on a curved atraumatic needle.

The use of the apparatus described has simplified the administration of whole blood by the intra-arterial route. Air embolus, a potential complication, has not occurred. This complication may be prevented by strict attention to detail in the administration of the blood. The apparatus has been used frequently both prophylactically and in emergencies. In several seriously ill patients it has proved to be a life-saving procedure.

CONCLUSIONS

In the administration of blood by the arterial route the use of the radial artery is preferred. A periodic determination of the venous pressure permits the replacement of blood on a physiologic and not an empirical basis. This is particularly applicable in patients in whom the cardiac reserve is diminished. In selected instances the occurrence of shock may be anticipated and an artery rather than a vein selected for the routine administration of blood.

SUMMARY

An apparatus to simplify the administration of whole blood by the arterial route has been described. The apparatus has been used repeatedly and the results obtained have been highly satisfactory.

In the treatment of bronchial asthma G. Maragliano prefers to inject bilaterally a solution of alcohol into the stellate ganglion and to include the superior cervical and the second thoracic ganglia as well, instead of resorting to other surgical procedures. He states the injections may be safely repeated as needed to obtain satisfactory results. (*Richard A. Leonardo, M.D.*)

FUNCTIONAL FULL LENGTH LEG BRACE*

A PROSTHETIC AID IN THE TREATMENT OF POLIOMYELITIS, FLACCID PARALYSIS AND FRACTURE CASES

COMDR. THOMAS J. CANTY, M.C., U.S.N.
Oakland, California

THE conventional full length brace used for orthopedic and paralysis cases is generally provided with a knee lock which may be disengaged for sitting. When using a brace with a knee lock the patient is required to walk in an unnatural, stiff-legged manner and the knee joint is further immobilized, thereby causing additional disability.

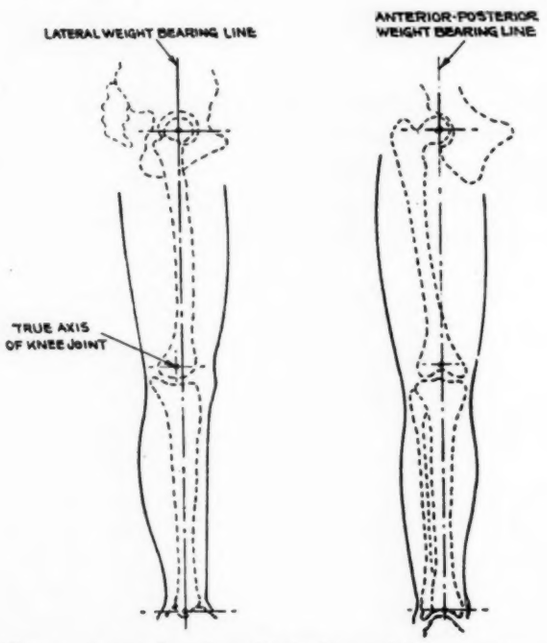

FIG. 1. Frontal and sagittal views of lower extremity showing relation of various axes to the weight-bearing line. (Official photograph, U. S. Navy.)

Appliances have been designed employing a free hinge joint at the knee, but these have proven to be unsatisfactory in many cases because buckling (jackknifing) at the knee has caused many patients to fall, resulting in additional injury and even fracture of the leg.

In the human lower extremity stability of the knee joint lies in the number, size and arrangement of the internal and external ligaments, the powerful muscles and fascial expansions passing over the articulation.[1]

Contrary to general belief, only slight muscular activity occurs in the lower extremity while standing. This is shown by work accomplished at the University of California Prosthetic Devices Research Project on electrical myographic studies of muscular activity during standing and walking.[2]

The body maintains the upright position and sustains its weight by the counterforces exerted through the anatomic configuration of the bones. The activity of the major muscles accelerates and deaccelerates the various bones in their relative positions of change in the various planes of space through action at the joints.[3]

While standing the human lower extremity utilizes the principle of placement of the knee joint axis at a point posterior to the lateral weight-bearing line. (Fig. 1.)

This principle has been employed for many years in the alignment of above-knee artificial legs in order to allow stability of the knee and yet permit the knee to flex freely during the swing phase of the walking cycle.

In July, 1946, it occurred to the writer that this principle could be adapted to advantage in a full length weight-bearing brace. A number of braces were so designed and fitted (Fig. 2) and cautiously observed on a number of patients in order to determine the inherent advantages and disadvantages. (Fig. 3.)

In manufacturing the new brace the more the center of the knee axis is placed posterior to the standing weight-bearing line, the greater the locking force on weight bearing through a relatively simple mechanical advantage. At the knee joint the uprights are curved posteriorly and joined at an axis which is superimposed over the human knee joint axis. The more weight borne during the weight-bearing phase

* The opinions or insertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large. From the U. S. Naval Hospital, Oakland, Calif.

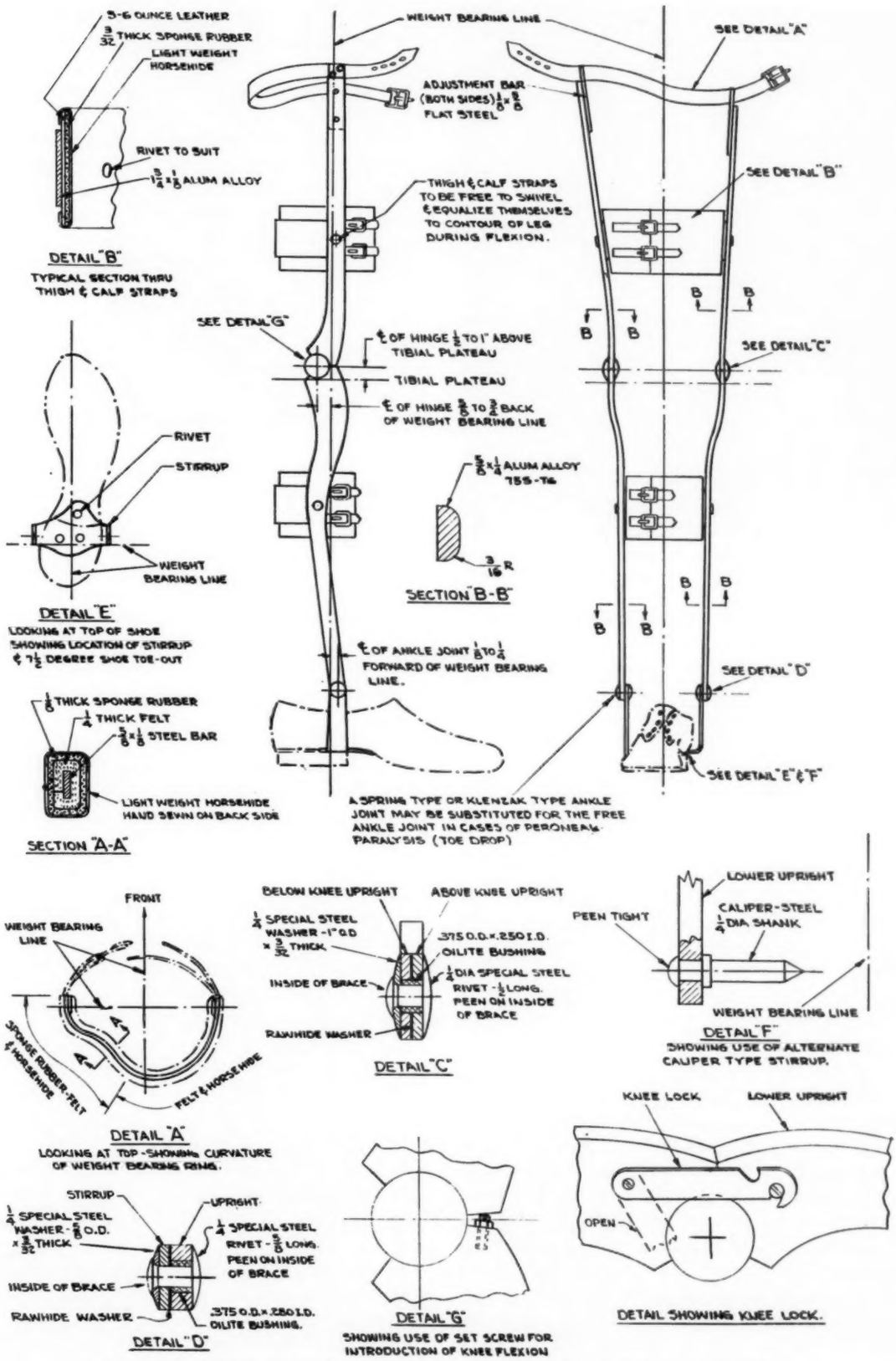
5-6 OUNCE LEATHER
3/32 THICK SPONGE RUBBER
LIGHT WEIGHT HORSEHIDE
RIVET TO SUIT
1 3/4 x 1/8 ALUM ALLOY
DETAIL "B"
TYPICAL SECTION THRU THIGH & CALF STRAPS
WEIGHT BEARING LINE
SEE DETAIL "A"
ADJUSTMENT BAR (BOTH SIDES) 1/8 x 3/8 FLAT STEEL
SEE DETAIL "B"
THIGH & CALF STRAPS TO BE FREE TO SWIVEL & EQUALIZE THEMSELVES TO CONTOUR OF LEG DURING FLEXION.
SEE DETAIL "G"
℄ OF HINGE 1/2 TO 1" ABOVE TIBIAL PLATEAU
TIBIAL PLATEAU
℄ OF HINGE 3/8 TO 3/4 BACK OF WEIGHT BEARING LINE
SEE DETAIL "C"
RIVET
STIRRUP
WEIGHT BEARING LINE
DETAIL "E"
LOOKING AT TOP OF SHOE SHOWING LOCATION OF STIRRUP & 7 1/2 DEGREE SHOE TOE-OUT
5/8 x 1/4 ALUM ALLOY 75S-T6
3/16 R
SECTION "B-B"
1/8 THICK SPONGE RUBBER
1/4 THICK FELT
5/8 x 1/8 STEEL BAR
LIGHT WEIGHT HORSEHIDE HAND SEWN ON BACK SIDE
SECTION "A-A"
℄ OF ANKLE JOINT 1/8 TO 1/4 FORWARD OF WEIGHT BEARING LINE.
A SPRING TYPE OR KLENZAK TYPE ANKLE JOINT MAY BE SUBSTITUTED FOR THE FREE ANKLE JOINT IN CASES OF PERONEAL PARALYSIS (TOE DROP)
SEE DETAIL "D"
SEE DETAIL "E" & "F"
FRONT
WEIGHT BEARING LINE
SPONGE RUBBER-FELT & HORSEHIDE
FELT & HORSEHIDE
DETAIL "A"
LOOKING AT TOP - SHOWING CURVATURE OF WEIGHT BEARING RING.
BELOW KNEE UPRIGHT
ABOVE KNEE UPRIGHT
1/4 SPECIAL STEEL WASHER - 1" O.D. x 3/32 THICK
.375 O.D. x .250 I.D. OILITE BUSHING
1/4 DIA SPECIAL STEEL RIVET - 1/2 LONG. PEEN ON INSIDE OF BRACE
INSIDE OF BRACE
RAWHIDE WASHER
DETAIL "C"
LOWER UPRIGHT
PEEN TIGHT
CALIPER - STEEL 1/4 DIA SHANK
WEIGHT BEARING LINE
DETAIL "F"
SHOWING USE OF ALTERNATE CALIPER TYPE STIRRUP.
STIRRUP
UPRIGHT
1/4 SPECIAL STEEL WASHER - 5/8 O.D. x 3/32 THICK
1/4 SPECIAL STEEL RIVET - 5/8 LONG. PEEN ON INSIDE OF BRACE
INSIDE OF BRACE
RAWHIDE WASHER
.375 O.D. x .250 I.D. OILITE BUSHING.
DETAIL "D"
DETAIL "G"
SHOWING USE OF SET SCREW FOR INTRODUCTION OF KNEE FLEXION
KNEE LOCK
LOWER UPRIGHT
OPEN
DETAIL SHOWING KNEE LOCK.

FIG. 2. Detailed drawings of functional brace. (Official photograph, U. S. Navy.)

FIG. 3. Patient walking in functional brace with knee flexing normally. (Official photograph, U. S. Navy.)

of the walking cycle, the stronger the locking tendency becomes.

As the patient becomes progressively experienced and develops more strength and confidence in his walking ability, it becomes more desirable to place the axis of the knee joint nearer the standing weight-bearing line and thereby approach the point of readiness for knee flexion. This is accomplished for all practical purposes by an adjustable lock screw which controls the degree of extension of the brace. Knee flexion is then more readily possible and requires less effort on the part of the thigh flexors. Should the knee axis be placed anterior to the weight-bearing line, buckling would occur with almost every step unless the patient is able to exert considerable force on the extensors of the thigh.

The average fractured femur requires approximately six months' immobilization in plaster in order to allow callus formation at the fracture site and subsequent calcification to such a degree as will allow limited weight bearing. It has been the general practice following the initial six-month period in plaster to place the fractured femur in a brace for an additional five- to six-month period. On the average about twelve months' hospitalization has been necessary for the service patient with a fractured femur before he is fit to perform full duty. In civilian life an equal period of time is required except that the patient convalesces at home. As a rule he is unable to return to work requiring full physical activity, particularly walking, for a period of one year.

After immobilization in plaster of paris edema and stiffness of the knee are generally present and circulation in the extremity is usually impaired. Muscular tone and strength are greatly reduced due to atrophy of disuse.

Patients treated with skeletal fixation in traction allowing early motion about the proximal joints have fewer of these complications than a patient immobilized in a plaster cast. One of the advantages of internal fixation by metal plates, Stader apparatus or intramedullary pinning is the early return of function to the extremity. Months of convalescence with the aid of braces and crutches are still required before the extremity returns to possible maximum function.

Further immobilization in a brace, especially in the knee joint, increases the permanent disability and delays return of function. Under ideal conditions with active physiotherapy and the use of swimming in a heated pool the convalescent period is long and drawn out and the degree of permanent disability in any given extremity is high.

According to Kessler,[4] who reported on a series of 164 cases with fractured femurs, the range of total disability extended from 5 to 100 per cent with an average of 26.6 per cent for the entire group.

It has been observed that a brace allowing the extremity to function through its weight bearing and swing phases of walking rapidly improves the disability and counteracts the complications of edema, stiffness of the knee joint and atrophy of the muscles. Nature heals much more rapidly in an extremity able to function normally, and even callus formation of the fractured bone ends increases and calcifies when it partly bears weight. This is readily shown in cases in which a fractured femur walks in a functional knee, weight-bearing brace. Check x-rays show a shower of callus in a matter of a few weeks after walking in the brace with the knee bending in a normal manner. (Figs. 4 and 5.)

Further advantages of walking in a functional brace are the prompt and early return of full motion to the knee joint, improvement in the circulation of the extremity with the disappear-

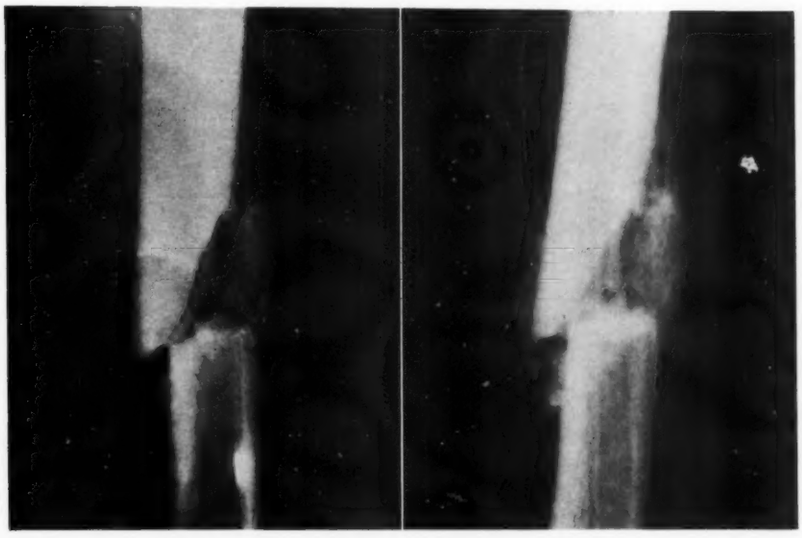

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FIG. 4. Fracture of the shaft of the femur showing slight callus formation after immobilization for six months in plaster of paris cast. (Official photograph, U. S. Navy.)

FIG. 5. Check x-ray of the same case showing excellent callus formation at the site of the fracture after six weeks' walking in a functional brace. (Official photograph, U. S. Navy.)

ance of edema and improvement of tone and power of the musculature overcoming atrophy of disuse.

The period of morbidity and convalescence is reduced as much as one-half. Our patients with fractured femurs on the average are now returning to full duty in a period of nine months following date of injury. The period spent in the brace is from six weeks to three months instead of double that time in a conventional type brace.

The first cases of fracture treated with the functional knee, full length, weight-bearing brace were so successful and proved to be of such worth that we believed this type of brace could be used to advantage in poliomyelitis cases, and a number of patients with bilateral poliomyelitis were so fitted. (Figs. 6 and 7.) In one of these cases the patient had had severe paralysis for seven years and her extremities were atrophied to an advanced degree. After seven months of walking with the functional braces incorporating a spring foot-drop device this patient was able to discard her braces, with the exception of the foot-drop device, and walk for a distance of 2 to 3 miles per day. During this entire period physiotherapy was maintained to a high degree and part of the return function must be attributed to the therapy received. Physiotherapy included muscle reeducation, progressive resistive muscular exercises and treatments in the Hubbard tank and the swimming pool. On three occasions it was necessary to enlarge the cuffs on the brace to allow for growth of the improved muscle groups.

To date twenty patients with paralysis and eighty with fractures have been fitted with functional braces.

Our experience has shown that spastic paralytics are unable to utilize this brace efficiently because spasm of the flexors promptly produces buckling at the knee. Patients with paraplegia and other flaccid types of paralysis can use braces of this type to advantage providing they retain some powers of flexion and extension in the thigh. We have found that in very early cases of paralysis with very weak flexors and extensors of the thigh it is necessary to put a lock across the knee section of the brace until strength improves to the point where the lock can be left off and finally discarded.

The weight of the brace is an important factor because even the minimum dead weight on a diseased or weakened extremity requires additional effort on the part of the extremity which is already subnormal and taxes its endurance and shortens the interval to the fatigue

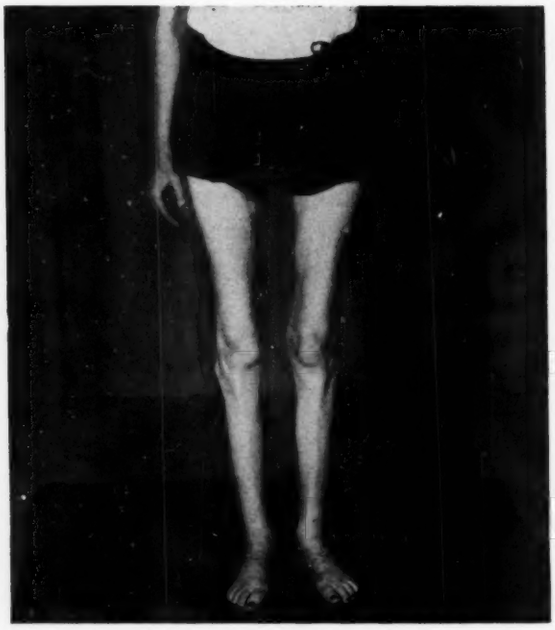

FIG. 6. Anterior view of a patient with poliomyelitis, with marked paralysis of both legs. (Official photograph, U. S. Navy.)

point rapidly. During the past war various alloys of aluminum were developed for the aviation industry; we have utilized some of the more recent alloys. Through experience we have found that 75 S-T6 aluminum is by far the best material available today. The brace can be manufactured from various types of steel. The weight of the aluminum alloy functional brace is about 3 pounds.

It is important that the ischial ring be fitted directly under the tuberosity of the ischium and that the shape of the ischial ring conform to the muscular pattern of the extremity at that level. A sponge rubber padding of the ischial ring is far more comfortable than a hard surface. The bands passing around the extremity should be padded with sponge rubber for comfort to the wearer. These bands should be pivoted so that when the knee is flexed, as encountered in ascending and descending stairs, on slopes and while sitting, the band is free to swing and comply with alterations in the shape of the extremity. The alignment of the brace is critical. The joint axes should conform to the same level of the human joint axes of the knee and ankle. (Fig. 8.)

We have successfully fitted bilateral functional braces to a patient with gluteal weight bearing. (Figs. 9 and 10.) An ischial ring was prohibited because of the necessity of wearing

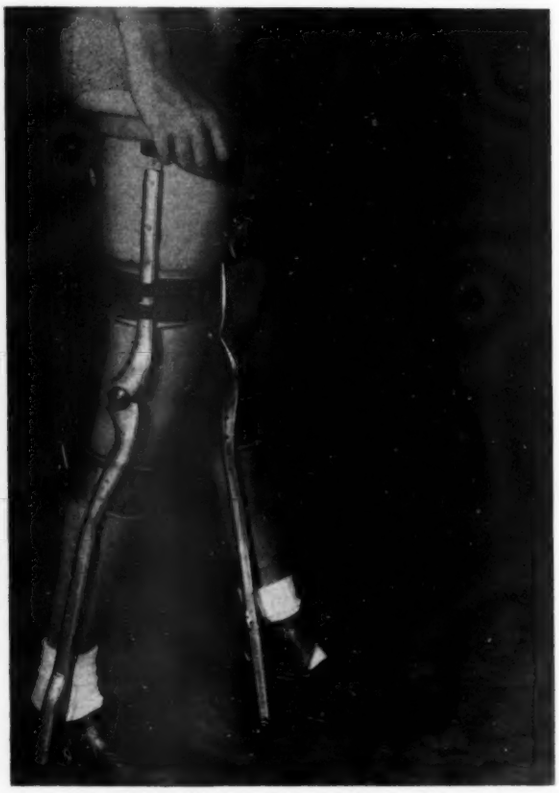

FIG. 7. Poliomyelitis patient walking with the functional braces. (Official photograph, U. S. Navy.)

rubber diapers due to the bladder and bowel paralysis. In twelve months' time this patient has progressed to the stage where she can walk readily with the help of crutches, and has taken a half dozen steps without the use of crutches.

In a case of peroneal paralysis (foot-drop) a spring type ankle joint may be added to the brace to alleviate this condition. The spring return of dorsiflexion prevents the scraping of the forefoot on the floor and stretches the achilles tendon, thereby preventing contractures, and helps to keep the dorsiflexor muscles in tone.

Many conventional braces are fitted with a right angle dorsal ankle stop and patients are able to walk with this type brace. Limitation of plantar flexion tends to cause buckling at the knee. It is believed that this is improper because a right angle dorsal ankle stop limits plantar flexion and restricts the muscles of the calf. We believe that all the muscles about a joint acting on the various bony levers should not be restricted in any way and should be free to move through their maximum range.

FIG. 8. Posterior view; note the padded ischial ring fitted directly under the ischial tuberosity for weight bearing. (Official photograph, U. S. Navy.)

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FIG. 9. Lateral view of a child with arrested hydrocephalus and spina bifida with marked paralysis and atrophy of both lower extremities, bilateral talipes equinovarus (clubfoot) and paralysis of the bladder and bowels. (Official photograph, U. S. Navy.)

FIG. 10. Child fitted with functional braces utilizing gluteal bearing and corrective shoes; note the patient has improved mentally as well as physically since walking in braces. In spite of the hydrocephalus this child is fairly intelligent for her age. (Official photograph, U. S. Navy.)

The use of a moulded leather thigh or lower leg cuff is desirable in fractures of the femur or tibia in order to prevent both anteroposterior and lateral-medial bowing at the fracture site.

At the best, an orthopedic brace is a heavy, cumbersome, uncomfortable and unsightly appliance but is necessary in order to provide support to the diseased or injured extremity when there is insufficient healing of the bone structure to support the weight or when the extensors of the thigh are so weakened that they are unable to exert the necessary forces on the femur to hold the joint axis posterior to the standing weight-bearing line.

CONCLUSIONS

1. The need for external support to a diseased or injured extremity by means of external braces is reiterated.

2. The principle of free motion at the joints in braces is advocated.

3. The full length, functional knee brace designed to comply with this principle has been found to be of benefit in cases of poliomyelitis, flaccid paralysis and fractures of the lower extremity.

REFERENCES

1. Morris' Human Anatomy. Edited by C. M. Jackson. 8th ed., p. 325. Philadelphia, 1925. Blakiston's Son & Co.
2. Report to National Research Council, Committee on Artificial Limbs, on Fundamental Studies of Human Locomotion and Other Information Relating to Design of Artificial Limbs, part 1. 1: 3–1 to 3–36. Published by University of California, Berkeley, Calif., 1947.
3. Canty, T. J. and Ware, R. M. Suction socket for above knee prosthesis. *Nav. M. Bull.*, 49: 223, 1949.
4. Kessler, Henry H. Accidental Injuries. 2nd ed., chapt. 8, pp. 249–251.

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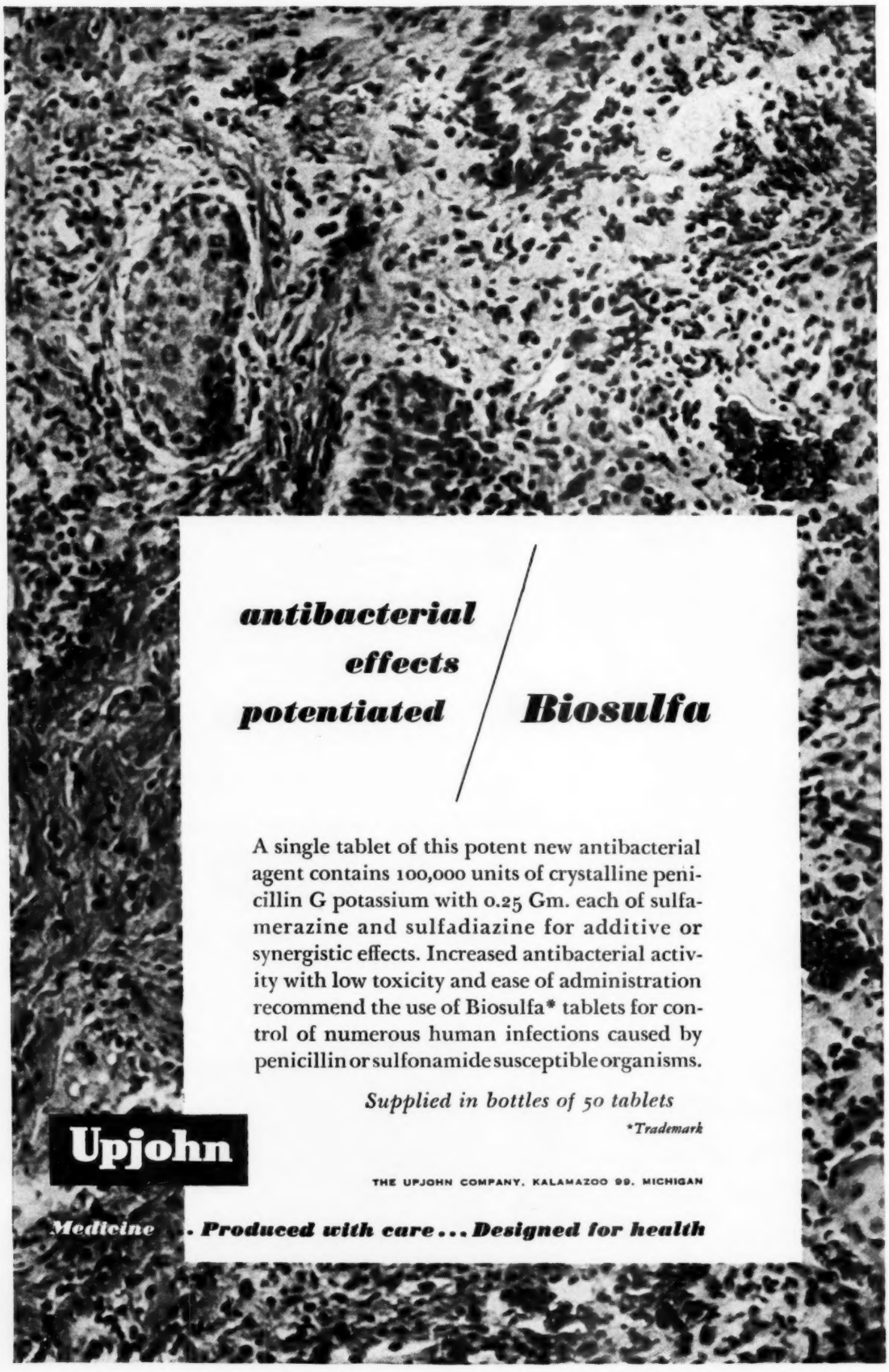

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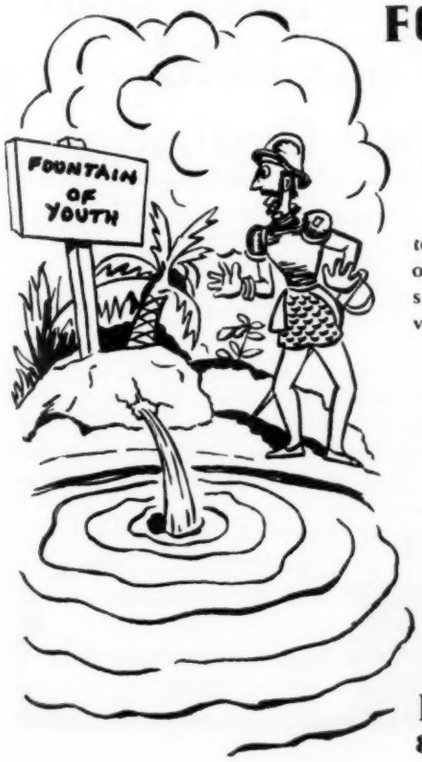

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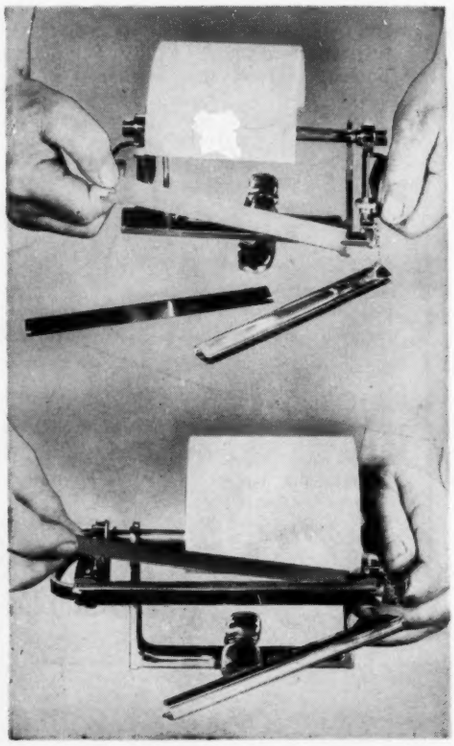

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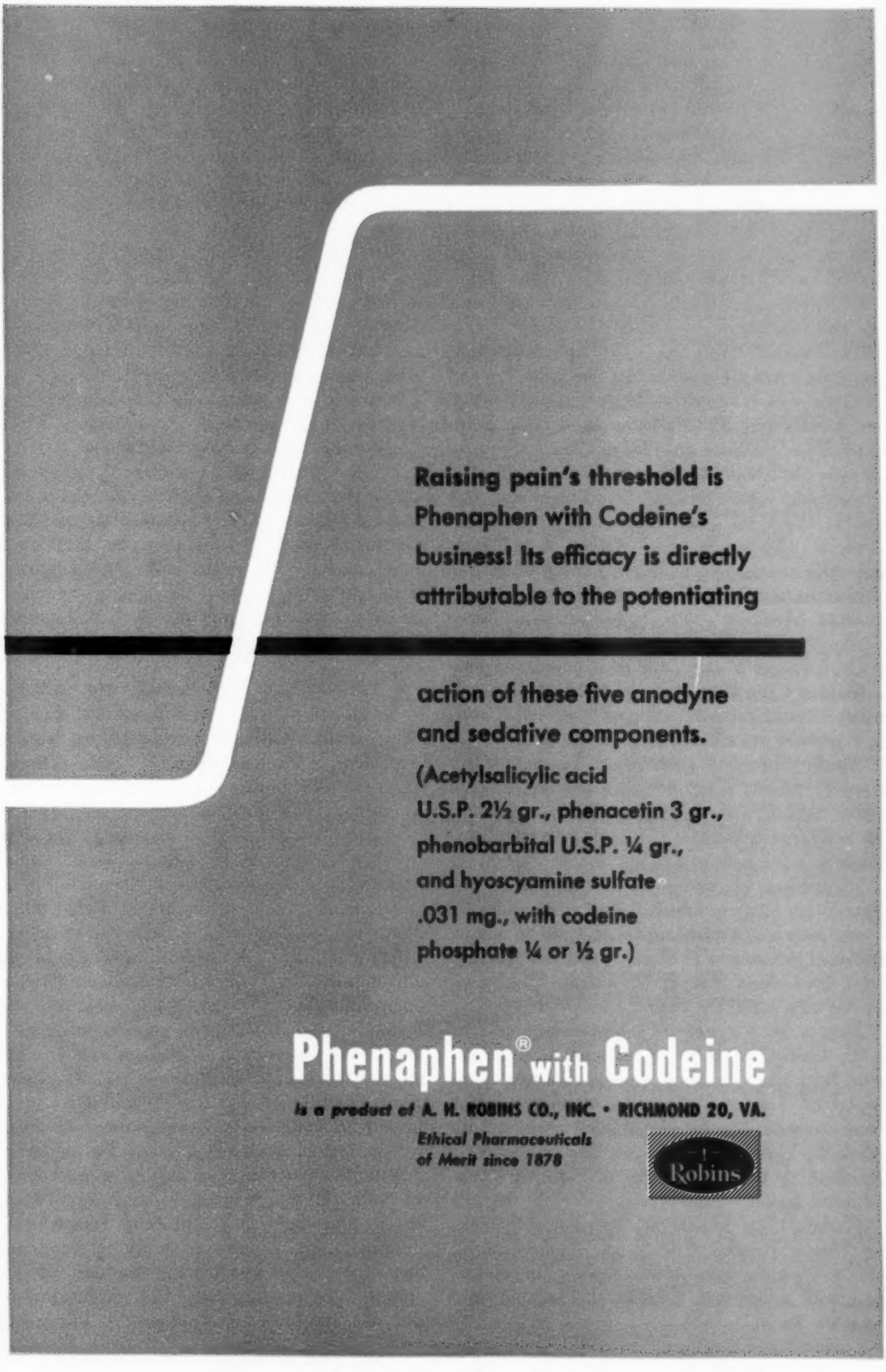
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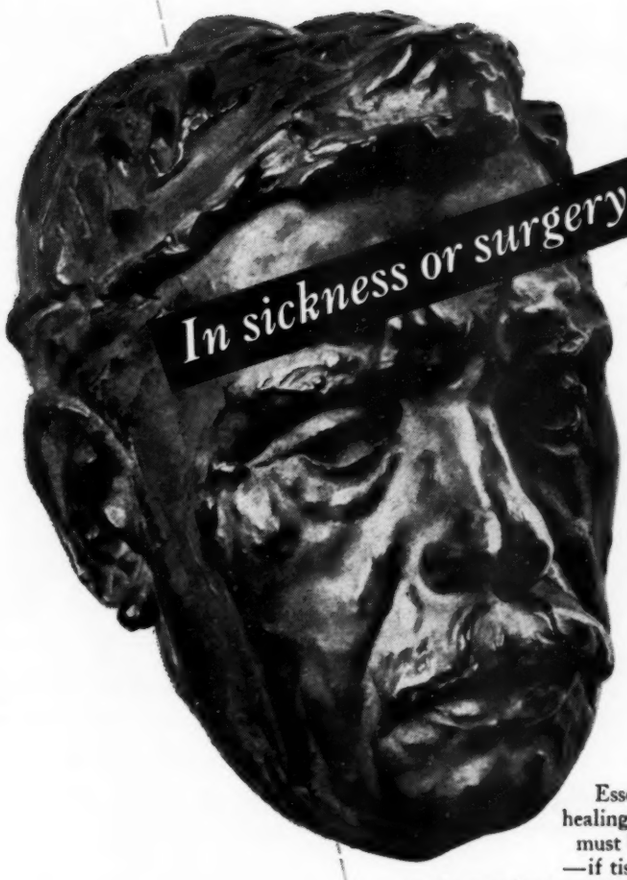

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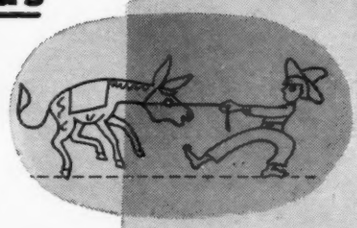

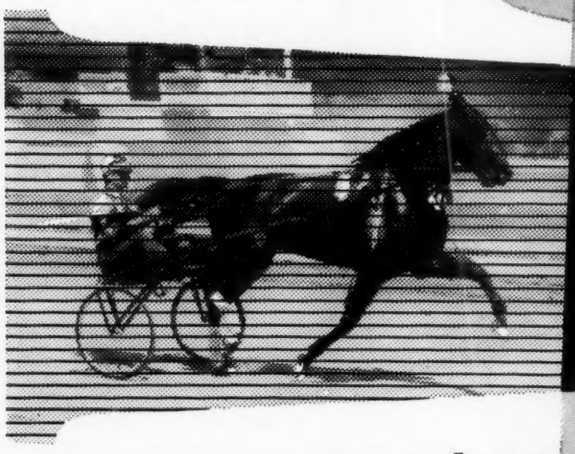

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1. Connor, C. L.: The Etiology and Pathogenesis of Alcoholic Cirrhosis of the Liver, J.A.M.A. 112:387 (Feb. 4) 1939.

2. Patek, A. J., Jr.; Post, J.; Ratnoff, O. D.; Mankin, H., and Hillman, R. W.: Dietary Treatment of Cirrhosis of the Liver, J.A.M.A. 138:543 (Oct. 23) 1948.

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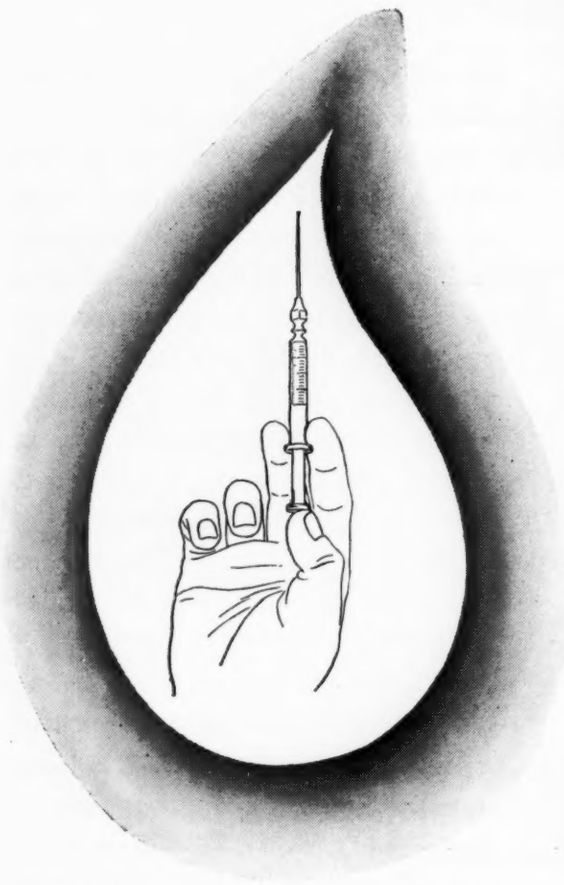

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(1) Tompsett, R., and McDermott, W., Am. J. Med. *7*: 371-381, Sept. 1949. (2) Tompsett, R., Ann. Otol., Rhin. & Laryng. *57*: 181, March 1948. (3) Sweany, H. C., Dis. Chest *15*: 631-656, June 1949. (4) Lincoln, S., Science News Letter *55*: 307, May 14, 1949. (5) Semans, J. H., J. M. A. Georgia *38*: 477-480, Nov. 1949. (6) Domon, C. M., Kilbourne, P. C., and King, E. Q., Amer. Rev. Tuberc. *60*: 564, 575, Nov. 1949. (7) Nagley, M. M., Brit. M. J. *1*: 248, Jan. 28, 1950 (in correspondence). (8) Committee on Medical Research and Therapy, American Trudeau Society, Am. Rev. Tuberc. *61*: 436-440, March 1950. (9) Carr, D. T., Hinshaw, H. C., Pfuetze, K. H., and Brown, H. A., Dis. Chest *16*: 801-821, Dec. 1949. (10) Odell, J. M., Dis. Chest *16*: 818, Dec. 1949. (11) (Editorial) New England J. Med. *240*: 736, May 5, 1949. (12) Keefer, C. S., Ann. Int. Med. *33*: 582-589, Sept. 1950. (13) Marsh, D. F., W. Va. Med. J. *45*: 280-284, Oct. 1949. (14) Johnson, H. M., J. Invest. Dermat. *15*: 61-66, July 1950. (15) Hinshaw, H. C., Personal communication. (16) Lincoln, N. S., Horton, R., Stokes, A. M., Monroe, J., and Riggins, H. M., Am. Rev. Tuberc. *62*: 572-581, Dec. 1950. (17) Carr, D. T., Brown, H. A., Hogson, C. H., and Heilman, F. R., J. A. M. A. *143*: 1223-1225, Aug. 5, 1950. (18) Jacoby, A., Goldberg, W., Sobel, N., and Rosenthal, T., Am. J. Syph., Gonor. & Ven. Dis. *34*: 185-186, March 1950.

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